ENVIRONMENTAL ASSESSMENT BOARD

Ontario

ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

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DATE: Wednesday, May 29, 1991

BEFORE:

HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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L I S T o f E X H I B I T S

---Upon commencing at 10:02 a.m.

THE CHAIRMAN: Mr. Chapman.

RONALD TABOREK,
DAVID BARRIE,
JOHN KENNETH SNELSON,
JUDITH RYAN; Resumed.

MR. CHAPMAN: At the outset, Mr. Chairman, I had an opportunity both yesterday afternoon and this morning to speak to Mrs. Formusa about my questions. And I wish to make it clear that we had asked a question about water rentals, and it was assigned to this panel, and as result, we prepared some questions in that area.

However, after hearing the answers yesterday and after speaking with Mrs. Formusa, I will be asking those question when we get to hydraulic panel. And I just wanted to make it clear that was the case and the reason for my going into it yesterday.

THE CHAIRMAN: Right.

Now, we ended up yesterday, you were asking Ms. Ryan some questions about mercury in the water.

MR. CHAPMAN: And I will be deferring all questions relating to hydraulics until we get to the hydraulic panel.

And it has been made clear to me by Mrs.

Formusa that any questions that we may have relating to either the existing system - be it hydraulic, fossil or nuclear - or the future possibilities, the future systems, we will be allowed to ask those questions of the experts on the panels that are called on those respective panels.

THE CHAIRMAN: Well, I have a little bit of a concern about this in general, and that is that Ms. Ryan, in giving her evidence in chief, made the statement that the concentrations of mercury in fish appear to be within the range normally found in natural water bodies. And then, when confronted with a document prepared by Ontario Hydro, which indicated that there might be a problem with certain specific sites for mercury, then said that she wasn't able to answer that question.

That raises, in my mind -- speaking for myself, what weight, if any, can I give to the statement that she made in chief?

And I guess I should ask Mrs. Formusa that when Panel 8 -- is it Panel 8 you were talking about?

MRS. FORMUSA: No, Panel 6.

THE CHAIRMAN: Who is going to be there to answer that question on Panel 6? The question that

Mr. Chapman asked yesterday?

MRS. FORMUSA: Mr. Chapman and I discussed that question last night, and it was my suggestion that, because of the statement that Ms. Ryan made in her evidence in chief, he might want to ask here to clarify.

I think there was some confusion about reading the statement in the Little Jackfish EA and then looking at her statement in evidence in chief. And my suggestion was that he pose the question to her directly, with respect to what she said on the transcript, and that's a possibility.

But as far as Panel 6 goes, Mr. McCormick, who is on Panel 6, will be dealing with questions in respect to mercury concentrations. He was the individual, I believe, who was responsible for the work in that area on the Little Jackfish Environmental Assessment, and will be prepared to address both that statement and any other issues with respect to mercury, both in the province, generally, and with respect to the findings that have been made for Little Jackfish in that study.

But I think it would be a fair question to pose to Ms. Ryan, with respect to her evidence in chief, because I had understood from Mr. Chapman that

it could be read one way, and I guess I hadn't seen it that way. So, if he wishes to ask the witness, then I don't have a problem with that.

THE CHAIRMAN: Thank you, Mrs. Formusa.

MR. CHAPMAN: I will do that.

THE CHAIRMAN: Mr. Chapman

CROSS-EXAMINATION BY MR. CHAPMAN (Cont'd):

Q. Yes, Ms. Ryan, you have had an opportunity now to, I take it, go over both what you said and your answers yesterday, and do you wish to explain?

MS. RYAN: A. Yes, I would.

Q. Please.

A. I guess, having reread my direct evidence, I saw how it could be interpreted the way you were interpreting it.

The data you presented yesterday in the Little Jackfish Environmental Assessment does, in fact, indicate that mercury levels are higher in the Ogoki Reservoir than in the Little Jackfish River and in the control lake for that area.

I guess what the data does not indicate is what the levels were before development, or if there had been no development. And that is what I had wanted my direct evidence to indicate, that Ontario Hydro's

existing hydraulic reservoirs are very old, and we do not have pre-construction data for those reservoirs, so we really don't know what the levels were before construction, or would have been if there were no construction.

I did not mean to say that we don't think our reservoirs are the same as others in Manitoba and Quebec, where they do have before-and-after data and, in fact, see that the mercury levels are elevated after flooding and construction of the dam.

Q. There are scientific studies that Hydro recognizes that show--

A. That's correct, yes.

Q. --after the flooding of an area, as a result of a dam, the mercury levels are increased?

A. Are elevated, that is correct. And we are following those studies, since we don't have before-and-after data ourselves.

But the other fact is that the natural water bodies within Ontario have a large spread in the concentration of fish in them, so it's not easy to just look at the mercury level in a fish in a reservoir and be able to state unequivocally that it is elevated, only because of the reservoir. There may be other factors including natural variability.

Q. And I also understand that Hydro is presently conducting some studies; is that correct?

A. That is correct.

Q. Do you know, can you give me an idea about when they might have some reliable data from those studies, with respect to mercury?

A. The information, I guess there are two areas of study: one is in the mercury levels, both within reservoirs and lakes, in the areas where we are planning to do future development, to understand what is there now. And that is being carried out with the Ministry of the Environment, who do a lot of the testing of mercury levels in fish.

And I expect the results will be coming out with - I don't have a time frame - but with the progress on various hydraulic plan development.

The other area of study that we are doing, a more scientific study with different research organizations, is into the theoretical reasons for the cycling of mercury within the reservoirs, and understanding what causes it, and the types of actions that might be taken before a hydraulic development, to either prevent, or mitigate, the extent of which the mercury levels will rise in the reservoir after flooding.

Q. Right.

I intend to defer the rest of my questions on the hydraulic question until the appropriate panel. Thank you.

The next area I would like to get into is nuclear production forecasting. And I take it that you would agree that Hydro has suffered declining nuclear performance since early to the mid-1980s. Would you agree with that?

MR. BARRIE: A. Did you say from the early 1980s?

Q. Yes. Problems in the production of nuclear power.

A. I think the late 1980s, I would agree with.

Q. You are saying that there were no problems, and I mean quite serious problems, before the late 1980s?

A. Performance has deteriorated in the -- there are always problems in any kind of generation. The problems became more serious and the performance deteriorated in the latter part of the 1980s, as compared to the earlier part.

Q. What has been the cause of this decline, generally speaking? And I mean by that, the

decline in the performance of these nuclear generating stations that you had forecasted would be doing a lot better?

MR. SNELSON: A. I think we have already testified that there are two main types of reasons. One reason is a significant series of problems related to pressure tubes.

Q. Yes.

A. And the other is a whole host of small reasons which have accumulated to cause significant deterioration in performance, and I don't think we are able to sort out the individual reasons for that, but there are a variety of reasons in the miscellaneous category.

...

[10:15 a.m.] So, there is the one big one, which is pressure tubes; and the accumulation of smaller problems.

Q. Let's take a look at some of Hydro's past forecasts. And if you would, please, first of all, turn to the consistent energy set.

THE CHAIRMAN: Sorry, turn to which, please?

MR. CHAPMAN: The Ontario Hydro's consistent energy set, and it is found in the material that we filed yesterday. It is right near the back of the material and it consists of five pages and the cover page. Basically, they are tables of figures.

THE CHAIRMAN: It's labelled CES; is that right, in the tabs?

MR. CHAPMAN: Yes, it is.

THE CHAIRMAN: And they are looking at Table 5.3, is that right, in that document?

MR. CHAPMAN: Just one moment, please. Excuse me one moment.

The first one, yes, is Table 5.3.

THE CHAIRMAN: Now, we have two 5.3s, one that was in the binder and one that was loose. Which one is it we are looking at? They seem to be different. At least, there is a third note in one and

there is not a third note in the other.

MR. CHAPMAN: I am advised it's the one in the binder, Mr. Chairman.

THE CHAIRMAN: It's got 1991 in it. All right. Thank you.

MR. CHAPMAN: Do you have that page?

Q. Now, the first table is the 1985 forecast; is that correct?

MS. PATTERSON: It's the one not in the binder.

THE CHAIRMAN: It starts in '86. The loose one starts with '85.

MR. CHAPMAN: May I see the document that you looking at?

THE CHAIRMAN: There are two documents, 5.3, one that goes from 1985 to '90.

It is the one in the binder then. Everybody looking at the one in the binder? All right.

MR. CHAPMAN: Q. If we look at this document, on the left-hand column, under Resources, we have nuclear I/S, and two rows down, two items down, we have commissioning net. And when we go over to 1990, which is what I am first concerned with, is it a fact that, when you add the nuclear I/S, which under 1990 is 89,919, to the commissioning net, which is minus 58--

THE CHAIRMAN: No, no. Yes, all right. Sorry. Go ahead.

MR. CHAPMAN: Q. --that the total of those two numbers, or the combination of those two numbers, is the forecast that Hydro made back in 1985, as to what the energy production of the nuclear plants was going to be in 1990; is that correct?

MR. BARRIE: A. That's correct.

Q. The forecast in '85 was that '90 would be the total production, and I understand - and correct me if I am wrong - but I believe that, in 1990, the actual production figure was 59.

THE CHAIRMAN: 59?

MR. CHAPMAN: Yes. 59.4 or 6.

DR. CONNELL: Terawatthours?

MR. CHAPMAN: Yes.

THE CHAIRMAN: 59 point, I'm sorry?

MR. CHAPMAN: .46, I understand.

THE CHAIRMAN: That will be 59,146 gigawatts; is that right?

MR. CHAPMAN: That's correct.

THE CHAIRMAN: Gigawatthours, I guess.

Are you drawing that actual from some source?

MR. CHAPMAN: From the annual report.

MR. SNELSON: Is that one of the documents you put in front of us, Mr. Chapman?

MR. CHAPMAN: The annual report is listed, and on the last page of that annual report, it is immediately preceding the consistent energy set, the document that I have been referring to.

MR. SNELSON: We have the annual report.

MR. CHAPMAN: Q. Yes. Does that not indicate that the actual production in 1990 was 59.4 terawatthours?

MR. SNELSON: A. You have obtained that by multiplying the 43.3 per cent of total system energy that is given in the text--

Q. Yes.

A. --by the total energy production?

Q. That's correct.

A. The number isn't the right order of magnitude. There may be some very minor adjustments but I don't know.

I would like to add one further element to my earlier answer about the main reasons for poorer-than-forecast nuclear performance, and the factor that is an additional factor in 1990 and 1991 is the late in-service and reduced energy production from Darlington. That's the third significant category. It

doesn't come into my pressure tube and miscellaneous categories.

Q. All right. And when Hydro was forecasting back from 1985, right through until 1989, they were optimistically anticipating that Darlington, two of the units, would be on line, isn't that right, in 1990 and '91?

MR. BARRIE: A. Yes, that's correct.

MR. SNELSON: A. Our forecast was, yes.

Q. Let's just deal with that for a moment. Isn't it a fact that, had everything come out as planned in '85, and Darlington was on line, as you thought it would have been, that Darlington would have only accounted for approximately 12 terawatthours of the difference between 59.4 and 90?

MR. BARRIE: A. That's about right. You say, only 12; that's 12 of 30.

Q. Yes. But it wouldn't make up all the difference, would it?

A. No.

MR. SNELSON: A. I said there were three factors.

...

[10:25 a.m.] Q. Yes, I understand.

Now, let's look at again at the consistent energy set, the second page, which is Table 5.9, and this is the 1986 Hydro forecast; is that correct?

MR. BARRIE: A. This is the one that is labelled CES 87-2, November '86 at the top.

Q. Yes. That is Hydro's 1986 forecast for the future, isn't it?

A. The process is that we carry out this work, this energy balance, to produce the consistent energy set.

Q. Yes.

A. We do that at the end of a year, in this case, for November '86, but it is called the '87, because it is published in '87.

Q. All right.

A. So the work and the forecasts are as we believed them to be in November of 1986.

Q. All right. Now let's see what Hydro believed the future would be in November of 1986.

If we look at Pickering and Bruce, in the left-hand column, the Pickering total and the Bruce total, we get a figure of approximately 81, and again, I am referring to what happened in 1990, or the

forecasts for 1990.

Would you agree with that, it is approximately 81 terawatthours?

A. Yes, approximately.

Q. All right. And again, of course, we compare that to what the actual production was and it was 59 again; is that correct? You have already indicated it was.

A. Yes, according to this.

Q. All right. Now, the next document in this series is another table, with a date on the bottom of it, of April 1988.

Do you have that document?

A. Yes.

Q. And if we look over to the left-hand column, under "Nuclear," with the 2) and also in the left-hand column that we add commissioning net, which should be added; coming over to 1990, we get the addition of 78,819 and 672. And I suggest to you that that represents a forecast of 79 terawatthours; meaning back in 1988, Hydro believed that in 1990, the nuclear production would be 79.

A. Yes.

Q. Now we look at the next page. At the top it says "Table S2." The date at the bottom is

January '89. And again, I am referring to 1990. We add nuclear in-service with commissioning. We end up with a figure of 78; is that correct?

A. Yes.

Q. And again, that is much higher than the actual production, isn't it?

A. Yes.

Q. All right. And the next document is, again, Table 5.3 at the top. At the bottom, the date is January 1990. And I would ask you to go to the --

This again is a forecast document, is it not?

A. Yes.

Q. If you look in the left-hand column, "Nuclear," the forecast was for a total of 70 -- I am sorry, we have to add 71,242 with the figure down below, under "Commissioning," the nuclear, 1,586.

And so we find that the 1990 forecast, for 1990, was approximately 73?

A. Approximately, yes.

Q. When was that forecast made? I mean, here we are. We are having -- maybe I am calling it 1990 and I shouldn't be, but we are having a 1990 forecast; it is forecasting what is going to happen in 1990, and it is the difference between 78 and 59.

THE CHAIRMAN: 73.

MR. CHAPMAN: I am sorry, 73 and 59.

Q. How many months in advance was that forecast made?

MR. BARRIE: A. As I explained, the CES is dated January, 1990, the first one of the year. The forecasts that go into that are those that we believe to be true in the latter part of the previous year. So typically, October, November of '89.

Q. All right. So, these examples I have given you, I suggest, clearly show that the forecasts were always higher, significantly higher than the actuals, from the years 1985 right up until 1990?

A. The figures demonstrate that for 1990, we consistently overestimated the expected nuclear production for 1990.

Q. Yes.

A. Yes.

Q. Was there ever a year previous to 1990 in which you underestimated it -- during the late '80s?

A. I don't know.

MR. SNELSON: A. There were years in earlier years where underestimates -- not particularly for 1990, but, say, for the years like '81, '82, that

were made prior to that, that tended in some cases to be underestimates.

Q. But never after what, '85?

A. I haven't looked at the history in that much detail.

Q. All right.

Now, we are dealing here with a plan for the future, and I suggest to you that the nuclear capability factor in the last decade of service life of a unit, it should be expected to decline somewhat, shouldn't it?

MR. BARRIE: A. Can you repeat the question, sorry?

Q. Just looking at the nuclear capability factor in the last decade of the service of a nuclear unit, wouldn't you expect it to decline somewhat?

MR. TABOREK: A. If you will allow me to answer that, Mr. Chapman.

Q. Yes.

A. The answer is no. We have produced estimates of the performance of our various nuclear units on a yearly basis for the next ten years, and then a single estimate for the time beyond that.

The estimates basically show a

restoration of the historical good levels of performance, based on increased maintenance and rehabilitation of the stations. So, it does not follow that there need be a deterioration with life.

Q. Well, there very well could be, couldn't there?

A. Well, that, I think, is a hypothesis that you are making that I can't support. I cannot support that, no.

Q. And I am speaking just generally about the aging --

A. Well, as I mentioned in response to a earlier question, I think from Mr. Watson, aging alone is not an indicator of performance.

...

[10:35 a.m.] I think aging and care together are factors - and care in terms of maintenance and capital programs - which have to be taken together in judging performance.

Q. Yes. And --

A. And another factor that is important is that some parts of a station's life -- another word for aging is experience, and you do learn over time what has gone wrong in the past and you learn to handle those. And of course, there are always new things that you have to face, that is it nature of the electricity business. But you cannot from that kind of a situation go to an assertion that there will be deterioration with age.

Q. But there is a limit put on the lifetime of one of these units; isn't there?

A. Yes, there is.

Q. And that certainly has something to do with aging, doesn't it?

A. It is basically a set of four factors -- well, here we go. Aging --

Q. My question was: Does it have something to do with aging?

A. No.

Q. The setting of the 40-year level --

A. Could you please define aging so I may answer that more precisely.

Q. Wear and tear and getting older with age.

A. Okay.

Q. And I am asking you --

A. There are two --

Q. If I could just finish. I am asking you if that doesn't have something to do with Hydro setting a 40-year limit on the lifetime of their units. That's my question.

A. Yes, it does. There are two factors, though, that you have indicated that have to be taken separately. One is the passage of time and one is the wear and tear. And a third consideration is the fact that a component runs out of life at a particular age does not necessarily reflect that it performs badly in the time leading up to that.

So that, for instance, fatigue stresses may reach a critically defined level after some period of time and hence you would say that should come out of service as a result of that. But that doesn't mean that it has performed poorly up to that point in time.

Q. And fatigue fractures - and you correct me if I am wrong - are brought about by wear

and tear over a period of time.

A. That's correct.

THE CHAIRMAN: Perhaps now we should make Ontario Hydro's Consistent Energy Set an exhibit.

MR. CHAPMAN: Yes, please.

THE CHAIRMAN: That means that Tables 5.3, dated September '85; 5.9, dated November '86; 5.3 again, dated April '88; and S2, dated January '89; and Table 5.3, dated January '90. Now, that does not include the loose document because it wasn't referred to in the cross-examination.

MR. CHAPMAN: And it won't be necessary to include that loose document.

THE CHAIRMAN: So, that will be collectively what number?

MS. MORRISON: 156.

---EXHIBIT NO 156: Excerpts from Ontario Hydro's Consistent Energy Set.

MR. BARRIE: If I can just say, Mr. Chairman, these are excerpts from the Consistent Energy Set?

THE CHAIRMAN: Yes, they are. I meant to make that clear. They are excerpts. They are really just the five tables.

Sorry, Mr. Chapman, you can go ahead now.

MR. CHAPMAN: Thank you.

Q. Now, if you would, please, turn to Interrogatory 2.2.33.

THE CHAIRMAN: Is it in the binder?

MR. CHAPMAN: I believe it was distributed just this morning. And it was not in the binder, no.

THE CHAIRMAN: It is the last interrogatory in the bundle of interrogatories that we have now. 2.2.33?

MR. CHAPMAN: Yes, 2.2.33, and it is a graph. And I understand that this graph corresponds to figure 4-19 in the Demand/Supply Plan at page 415.

Q. In other words, I put it to you that Interrogatory 2.2.33 is a more recent forecast than Figure 4-19 at page 4-15 in the Demand/Supply Plan; is that correct?

MR. BARRIE: A. Yes.

Q. And this interrogatory graph 2.2.33, it shows Hydro's expectations for production from the existing system, over the Demand/Supply Planning period; is that correct?

MR. TABOREK: A. Yes.

DR. CONNELL: May I just clarify? Can one assume that the fossil and hydraulic parts remain

as they were in 4-19? Or were they --

MR. TABOREK: That is my assessment, sir, yes.

MR. CHAPMAN: Q. Would you agree that --

MRS. FORMUSA: Could I just note the errata that was in Figure 4-19? You probably picked it up already.

THE CHAIRMAN: Yes, I picked it up. The colours are wrong.

MRS. FORMUSA: Yes, we sent out an errata sheet about that.

MR. CHAPMAN: The upper and lower but not the nuclear, yes.

Q. Now, dealing with the long term, would you agree that Hydro's nuclear plants are forecast to produce at or above 80 per cent productivity in the long term?

MR. SNELSON: A. The latest estimates of long-term capability of nuclear are in Exhibit 148.

Q. What about dealing with this graph. Does this graph indicate that Hydro forecasts the nuclear plants to produce at or above 80 per cent productivity, if you look at this graph?

MR. TABOREK: A. No. I am assuming this this graph is produced using the nuclear

incapabilities in the 1990 Reliability Indices Report. And this is a chart which I had used in my direct and I am looking at that. And the incapabilities for the nuclear system in the early '90s are roughly at the 30 per cent level, so that would be a 70 per cent performance.

Q. 70 per cent capability, yes.

A. Capability, yes. And they decline to the region of a little above 80 per cent by the end of the decade. Actually, I will put that on.

So, reminding that this is incapability, the number you are asking about is 100 minus this per cent, so I gave you that the incapability is about 30 and the capability about 70, and declining towards the 80 per cent level of the performance over the period.

Q. Beyond 2000.

A. In the years as indicated.

Q. What is it beyond 2000?

A. There will be an entry in the 1990 Reliability Indices Report labelled "Long Term" that would give the long-term number.

Q. But this chart does show beyond 2000, doesn't it, the chart --

A. Which chart now?

Q. 2.2.33.

A. Let me just check. Yes.

Q. And doesn't it indicate that the forecast is for about 80 per cent productivity in the long term, and I am talking about beyond 2000?

A. Well, I would...

MR. SNELSON: A. Can I take you to Exhibit 148, Section 1.2? And this is the 1990 edition of the Reliability Indices that was published earlier this month.

Q. I am afraid I don't have my hands on that document. But I do now. Yes. I have it.

A. You have that?

THE CHAIRMAN: Please give me the reference again.

MR. SNELSON: It's section 1.2.2, and the heading at the top of the page is 1.0 "Explanatory Notes," and it follows the list of contents and the foreword.

And at the bottom of the page, there is a section 1.2.2 which I will read. It says:

> "The target operating CbF - that is, capability factor - for all nuclear units is 85 per cent (outside of retubing); however, for the forecast period beyond the year 2000, the values have been

calculated as follows:

a) The CbF - capability factor - for the "A" stations for the period beyond the year 2000 have been calculated assuming a median operating CbF of 80 per cent, with a low of 75 per cent and a high of 85 per cent.

b) The CbF for the "B" stations and Darlington GS for the period beyond the year 2000 have been calculated assuming a median operating CbF of 85 per cent, with a low of 80 per cent and a high of 90 per cent."

MR. CHAPMAN: Q. So, if I could come back to my original question. What you have just told me I don't think detracts from my suggestion that this Interrogatory 2.2.33 depicts 80 per cent for the long term, that the nuclear plants will be operating at 80 per cent for the long term; is that correct?

MR. SNELSON: A. In the quote I gave you, the numbers were quoted as being outside of retubing. Retubing on a lifetime basis subtracts about 5 per cent capability factor. And so, the effect is to lower -- sorry, no, the "A" and "B" numbers have that effect in.

Q. It is already in there, isn't it?

A. It is already in there, sorry, I am incorrect.

Q. So you would agree with me that this graph generally depicts that the capability of these plants in the long term is about 80 per cent?

MR. TABOREK: A. Yes.

MR. SNELSON: A. I'm sorry, I'm sorry, I'm still...

The 85 per cent for the "B" stations is between retubings, so the effect of the retubings is additional to that which lowers the expected capability of nuclear stations to 80 per cent for the "B" stations and Darlington. And the "A" stations are somewhat lower than that, and so the net effect is a little bit lower than 80 per cent.

...

[10:50 a.m.] Q. So, that is what you will give me, a little lower than 80 per cent?

A. Yes.

Q. In the long term?

A. Yes.

THE CHAIRMAN: Perhaps, could you clarify it for me a bit? The component of this graph, 2.2.33, plots the median forecast for nuclear for the existing system, 1989 through to 2014.

MR. SNELSON: That is correct.

THE CHAIRMAN: What assumption of capability is that forecast based on?

MR. SNELSON: That is based on the assumptions of availability that are detailed, unit by unit, in Exhibit 148.

THE CHAIRMAN: All right. Thank you.

MR. CHAPMAN: Q. Now, that same figure, in Interrogatory 2.2.33, indicates that Hydro's nuclear plants produced about 59 terawatthours in 1990; is that correct?

MR. SNELSON: A. Yes, I believe we have already confirmed about that number.

Q. And Pickering and Bruce, I understand, have a combined capacity of about 10.6 gigawatts?

A. That sounds about right.

Q. Yes.

A. It can be confirmed from Chapter 4, if we want to go through the numbers, but it's about right.

Q. You are not quarreling with that figure, in any event?

A. No.

Q. In 1990, if Pickering and Bruce had operated at 80 per cent capacity, my estimate is they would have produced about 74.7 terawatthours.

Do you agree with that? In 1990, we are talking about Pickering and Bruce, and we are talking about them operating at 80 per cent capacity. I am suggesting to you that they would have produced about 74.7 terawatthours.

A. Near enough 74, yes.

Q. All right. Now, I also understand reading from Hydro's latest annual report, that 10 per cent of Ontario's power needs were met through imports that year.

MR. BARRIE: A. In 1990?

Q. Yes. Isn't that right?

A. Yes, approximately. Yes.

Q. Now, isn't it correct, sir, that if

Pickering and Bruce had operated at 80 per cent capacity, as they should have, you would have to agree that Ontario would have been self-sufficient in electricity in 1990 instead of having to import 10 per cent of our power as we did.

A. If Pickering and Bruce produced the electricity that you quoted, yes, that's correct.

Q. So, you would agree that currently our nuclear plants are producing less than hoped for?

A. They are producing less than 80 per cent, yes.

Q. And that's less than hoped for, isn't it?

MR. TABOREK: A. Mr. Chapman, I think the word "hoped for" is an unusual one.

Q. It's probably a bad choice of words.

A. I think it's actually worth picking up on that.

Q. Anticipated.

A. I have indicated "than forecast," I think.

We have indicated to you that while we make forecasts, and we believe we make forecasts as well as anyone can make forecasts. We, at the same time, recognize that forecasts - and I think we have

used these very words - are not likely to come about. So, "hoped for" is correct in a sense that it is nice when things go better, but in planning for the long-term system, for its reliability on its capacity side, and for being able to meet our energy commitments, you also recognize that things may go the other way.

Q. Yes.

A. And that, in this period, we continually noted for people the fact that nuclear units could produce less than expected, this would require certain actions on our part. We had margins in place to deal with these things, we had actions in place.

The operation of the power system is really the putting yourself in a position to deal with the myriads of uncertainties that will hit you, in which things are different than your forecast. And of course, if they are better than forecast, you have no problem, you sit back and relax.

The real business of operating and planning the power system is preparing yourself for all those things that can happen and hurt you. And that's why I reacted to the word "hoped for." It isn't quite suitable.

Q. Thank you.

Now, would you turn to Exhibit 148, which is Energy Probe's Interrogatory 2.2.22. And there is a table at page 16 of the report which is the forecast of incapability factor for the nuclear fuel units. And if we are talking about the Pickering "A" units, isn't it a fact that this table indicates that they are going to be operating at an 80 per cent capability factor in the last decade of their lives?

A. Yes.

Q. So, I take it that the table indicates that these units are not expected to experience an aging decline below an 80 per cent level of performance?

A. These units will have been retubed and rehabilitated and we consequently expect a return to historical levels of performance with these units.

Q. All right. Now, the oldest Pickering unit is just finishing its second decade; is that correct? Its birthday is...

A. Yes, I think 20 years old now.

Q. 20 years old next month; is that correct?

A. I will take your word for that.

Q. Yes. Now, I would like to go to

Interrogatory 9.2.31, which is found in...

THE CHAIRMAN: Where is it located?

MR. CHAPMAN: Energy Probe's material, 9.2.31. It's the CANDU Station Performance Newsletter, 90-12. There is a graphic depiction, Pickering NGS "A", Station Performance, and in the left-hand column, we have Unit 1, 2, 3, and 4.

Q. Do you have that document?

MR. BARRIE: A. Yes.

MR. SNELSON: A. Which year is this? Oh, 1990, I see it on the bottom there.

Q. Now, if we take since in-service figures, which is the last figure in each of those blocks, and reading Unit 1 at 64, Unit 2 at 59.3, Unit 3 at 71.4 and Unit 4 at 76.4, my assistants have worked out that average and it's 67.8 per cent.

A. I will accept your arithmetic.

Q. Not mine.

And so that means that Pickering "A" has managed only a 67.8 per cent capacity factor since it went into production.

A. That is true, but we have indicated that one of the major reasons for less nuclear production than we had forecast was troubles with pressure tubes. And that has been particularly

significant at Pickering "A" where the problem arose.

You will recall there was an incident where the pressure tube ruptured, and then two units were taken out of service for approximately three years or so, for an unplanned retubing. That has had a significant effect on that average.

And subsequent to that, the corrected measure is to retube Units 3 and 4, which is now being done on a planned basis, and that has had a significant impact on the Unit 3, and, to a lesser extent, Unit 4.

So, these are measures that are acknowledged and there are corrected measures underway to deal with that situation.

Q. I understand that. And there may well be problems in the future. You have already indicated that, haven't you, with any or all of these plants?

A. Yes.

Q. We are just looking at their past performance--

A. Yes.

Q. --and we are looking at your future forecast here?

A. Yes.

Q. I just want to get the facts out,

that's all.

And that means, I put it to you, that you are forecasting in this Demand/Supply Plan, and currently when the plan was drawn up and right now, that Pickering "A" will do much better in the last decade in its life than it did in the first two decades of its life. That's what your forecast is.

MR. TABOREK: A. I think it is necessary to view the time scales a little more finely than just to deal with blocks of decades.

If I may, I would like to --

Q. Excuse me. When I say the last decade of its life, I mean from age 30 to 40.

A. Yes. But you have also used the first decade, and it is necessary to look at the performance in the first decade in a little more detail, and to look at the causes of the different incapabilities that have arisen.

I am putting on the overhead a chart, Pickering Nuclear Generating Station "A" Incapability.

THE CHAIRMAN: Can you reference that, please?

MRS. FORMUSA: Exhibit 152.

THE CHAIRMAN: 152.

MR. TABOREK: This a totally new chart

that we won't have seen before.

THE CHAIRMAN: I should have my glasses on it. I thought I had seen it.

MR. TABOREK: Yes, they tend to look much the same, sir.

Earlier, I showed you nuclear incapability in total, which is the sum of all the stations. And on occasion, we introduced some new material on each of the fossil stations.

THE CHAIRMAN: Let's hold up for a minute. Let's put this Pickering Nuclear "A" Station Performance and CANDU Generated Chart as a number. Which one would that be?

MRS. MORRISON: 157.

---EXHIBIT NO. 157: Pickering Nuclear Generating Station "A" Performance. (Response to Interrogatory 9.2.31)

THE CHAIRMAN: 157. And the chart that Mr. Taborek has just put up will be 158.

MS. MORRISON: I believe it is 152.

THE CHAIRMAN: It is? He said it was a new chart, never put up before.

MR. TABOREK: I'm sorry.

MRS. FORMUSA: We did Pickering and Bruce, 153.

THE CHAIRMAN: 152 then.

MRS. FORMUSA: This is 152.

THE CHAIRMAN: All right.

MR. TABOREK: What you have done is averaged the incapability over the period from 1971 through what period? What period did you average your incapability over?

...

[11:04 a.m.] THE CHAIRMAN: Well, you would have to look at the chart. He didn't do it. The chart did it.

MR. TABOREK: To the end of '90. You will notice three distinct patterns appearing in this period. Pickering "A" was the first nuclear generating station and you see initial problems, which is traditional of failure curves. It is called teething problems and it happens with any complex new system.

Now, I would --

MR. CHAPMAN: Q. Teething problems, meaning the opposite to old age?

MR. TABOREK: A. The opposite to experience. The teething problems are unlikely to recur in the latter life of the plant. We will have got over those.

Having got over the teething problems, we entered a period of good performance. And then having gone through a period of good performance, we entered the problems with the pressure tubes that Mr. Snelson referred to.

There were some particular materials in these pressure tubes and we are routinely planning for retubing of all units, but having retubed, there will be a long period without further retubings.

And so, consequently, in planning

forward -- oh, there is, in addition, a rehab program in here. So, that in planning forward, I would suggest one shouldn't just take a average of the past years, one should make due allowances for the causes of the past problems and whether they will recur in the future.

And we would submit in these two instances, no. Your are correct, however, there will undoubtedly be new problems that will have to be dealt with. But we forecast that they will be dealt with within the times allocated in the forced and planned in total end capabilities, and with the funds that we are allocating to the stations.

MS. PATTERSON: So, are you saying, Mr. Taborek, that there is unlikely to be the necessity for more retubing before the end of the time for Pickering "A", for example.

MR. TABOREK: With Pickering "A", I think there is some uncertainty with respect to Pickering "A." The latest tubes that we have put in, what is the life we expect of them?

MR. SNELSON: Oh, they are 30 years.

MR. TABOREK: No, I think we don't expect a retubing at Pickering "A." I am sorry. The tubes that are in now, we expect, I believe, a 30-year

life -- and 25 or 30 years, so that will take us beyond the 40-year life without another retubing.

MR. SNELSON: The experts on retubing -- as you have perhaps gathered, we can talk to this at a certain level of detail. And as regards to the forecast and how it affects the future plan, we are prepared to deal with it.

When it comes to the specifics of why one tube fails rather than another, then, while we have some general knowledge, the real experts will be on Panel 9.

DR. CONNELL: While we are on technical detail, just to refresh my understanding, the pressure tube contains the fuel rod; is that correct?

MR. SNELSON: The pressure tube contains a series of fuel bundles which have coolant flowing at a high temperature and pressure, through the pressure tube; and that coolant removes the heat from the fuel. So, the pressure tube contains that pressure.

DR. CONNELL: So, that the high pressure is inside the--

MR. SNELSON: The high pressure is inside the pressure tube.

DR. CONNELL: --pressure tube.

MR. CHAPMAN: Q. I thought Mr. Snelson

said that Pickering "A" was down for three years, but the graph seems to show five years.

Which was it?

MR. SNELSON: A. I said about three years. I haven't got a -- no, the number varied. There was a period for Unit 1, another period for Unit 2 and it was of that order of magnitude. It may have been five years for one of the units.

Q. All right.

A. I was just indicating several years.

Q. All right.

MR. BARRIE: A. Pickering 2 was out for five.

Q. I am sorry, Pickering 2 was out five?

A. Yes. And Pickering 1 about four, 3-1/2.

Q. All right.

MR. SNELSON: A. The retubing of Pickering 3, I think, is taking about two years; that is the planned retubing. The other retubings were on an unplanned basis.

Q. All right. Excuse me, please.

Now, at page 2864 of the testimony - I don't think you have to turn to it - there was testimony given in chief that, in 1982, all of the

nuclear stations had their lives increased to 40 years.

Do you recall that being said?

MR. TABOREK: A. I think what I said was that the "A" stations had been designed for 30 and had a 30-year life; the "B" had 40 years from the start; and that, in '82, all - i.e., the "A" stations - were increased to 40 years. All were made 40 years.

Q. And that means that their anticipated lifespan was increased 40 years from 30?

A. From 30 to 40, yes.

Q. Increased, yes, obviously?

A. Yes.

Q. Well, we know that, in 1983, there were problems discovered with pressure tubes in Pickering 1 and 2. Was there ever another adjustment made, maybe to decrease their life?

A. In that particular instance, you would not decrease the life of the nuclear station. You would decrease the life of the pressure tube, in that another change of pressure tubes would not affect significantly the economics of the nuclear station.

We have spent some time looking at the problem of pressure tube lives and we believe - and we are at the verge of where I would refer you to Panel 9 on nuclear - that the lives are such that further

retubings will not be necessary.

Q. Okay. And just by the way, while we are talking about this 40-year period, does anyone on this panel that I am questioning know of any other utility in the world that uses a 40-year period for the expected life of a nuclear reactor--

A. No, I am not --

Q. --outside of Canada?

A. No, but my knowledge of the depreciation practices of many other utilities is not extensive, so I am not giving you a meaningful answer.

Q. What is the DRC?

A. It is the Depreciation Review Committee.

Q. And I understand you are a member of that?

A. That's correct.

Q. You are not aware of any other utility in the world that uses a 40-year period for a expected life of a nuclear reactor?

A. No.

Q. All right. Now, if you turn to 2.22 again, which is the Exhibit 148, Table 11 on page 16.

In looking at the right-hand column, which is under "Long Term," all the long-term

projections for the performance of all the nuclear stations beyond a ten-year horizon are assumed to be very close to the 80 per cent capability factor, regardless of the unit age or design. Now, we will except out Bruce "A4" because the figure 30 is there.

But, generally speaking, the chart suggests that they are all, regardless of age or design, very close to the 80 per cent capability factor. Why are all these units in the long term expected to be so identical?

A. Well, for at least two reasons: One is they are all essentially the same design. They are all the CANDU design. And to the extent there are differences between the stations, they are variants, in effect, of the CANDU design.

Q. Variances of the design?

A. Yes.

Q. Yes. But there are variances?

A. Yes, and there are variances.

Q. Yes.

MR. SNELSON: A. I did indicate by reading the earlier section of this exhibit that the expected performance between retubings of the "A" stations is forecast to be worse than the "B" stations in Darlington by about five per cent, and that is a

difference.

Now, when you come to the differences between these units, Panel 9 can give you much more detail than we can.

Q. All right. Now --

MR. TABOREK: A. There is a second factor.

Q. I am sorry, go ahead.

A. Namely, that the design has a certain capability which can be economically achieved and it is economic to spend money to ensure that the units meet that capability. So, this isn't a chance outcome in total. It is also an effect of money being invested to achieve it.

Q. All right. Now, Mr. Taborek, you indicated in your evidence that Hydro isn't now planning for two units to be undergoing retubing simultaneously at any time in the 1990s?

A. No, I don't believe I said that.

Q. All right.

A. I believe I said no more than one in the '90s, but at some times in the 2000 period, there could be two out at a time.

Q. But, I think I asked you, if you didn't say, that there was the expectation now that

there would be no more than one. You are not now planning for two units to be undergoing retubing simultaneously at any time in the '90s?

A. I am sorry if I misheard you, Mr. Chapman; yes, you are right.

Q. And, of course, you can't be 100 per cent sure that that won't happen again, can you?

A. Well, indeed, the electricity business is such that there is no absolute on anything. We think it highly unlikely. And there are intensive monitoring programs and we have a good deal of experience now with our older units in the time periods where our younger units are entering, so that we think there is quite good evidence to support that.

Q. Could you turn to page 44 of your -- or I guess it is called page 44 of your slides?

THE CHAIRMAN: That be Exhibit 136; is that right?

MR. TABOREK: This is the direct evidence?

THE CHAIRMAN: Yes.

MR. CHAPMAN: Yes, the package of all the slides.

MR. TABOREK: Could you read the heading, please, to help me locate it.

MR. CHAPMAN: It is the overheads. It is the package of overheads, "Panel 2 existing system, overheads used by Messrs. Snelson and Taborek, Ms. Ryan and Mr. Barrie in direct evidence."

And I am asking you to turn to No. 44.

THE CHAIRMAN: Can you put that up, please? Do you put it up?

MR. CHAPMAN: I don't think it is necessary. If it is necessary to have it answered with it up, that is fine. I just have a simple question, I think.

THE CHAIRMAN: All right.

MR. CHAPMAN: Q. This No. 44 shows the energy meeting capability of the existing system, isn't that right?

...

[11:20 a.m.] MR. TABOREK: A. Yes, it does.

THE CHAIRMAN: That would be the top of the graph that you just showed a few minutes ago, with the segments in it.

MR. CHAPMAN: Q. Well, my question is, Mr. Chairman, does this account for reserve requirements, No. 44?

MR. TABOREK: A. No. Reserve requirements would be taken into account on the equivalent capacity chart which came earlier. It showed capacity, reserve, and load-meeting capability. In this particular chart, this deals with energy.

THE CHAIRMAN: Let me make sure I understand your answer. This is the chart which shows the energy-meeting capability of the existing system?

MR. TABOREK: Yes, sir.

THE CHAIRMAN: And you say the reserve is not taken into account?

MR. TABOREK: The reserve margin is not in there. It is in the earlier chart on capacity.

THE CHAIRMAN: So, the energy delivered from the system would have to be reduced to cover the reserve; is that right?

MR. TABOREK: No. If you will, the capacity and reserve are used to determine how many

generating stations and units you have in place. And, roughly speaking, you will have 24 per cent more in place than the load you expect to meet.

Now then, having got that in place, the energy chart is how you use those. And you then use enough to meet the load that you actually experience. And since this is meeting the forecast median load, you are not really using, to any significant extent, those units which are there for reserve purpose. They operate to a very low load factor, negligible inpact.

MR. CHAPMAN: I am going to leave that line of questioning.

Q. Now, just generally, I suggest that if nuclear production is more unreliable than the forecast, that it can have the following results. The reliability of the total service would go down?

MR. TABOREK: A. Other things being equal, yes.

Q. The cost of service goes up?

A. Yes.

Q. The economics of nuclear power look less favourable?

A. Yes.

Q. And acid gas control costs go up?

A. Yes.

Q. And finally in this area - and then I will be leaving nuclear forecasting - it's a hypothetical question. Take a hypothetical using nothing but a 24 per cent average reserve margin with no adders or subtracters, would you agree that a plant with a long lead time, with a high degree of unreliability, would be advantaged at the expense of a short lead time plant with a high degree of reliability?

A. Excuse me. Would be "advantaged"?

Q. Yes.

A. Could you explain that?

Q. From the point of view of economic analysis, you are taking an average, 24 per cent average is the average reserve margin. I am asking you, without any adders or subtracters.

A. Okay.

Q. One would look better than the other.

A. If I am understanding your hypothesis, as you stated it's correct. But the assumptions that you put in would not be those we would normally use. So, for instance, if we were doing reliability assessments and the resource that we were using for reliability purposes had a long lead time compared to one with a short lead time, then we would

have to have a larger reserve margin. And that's a very undesirable thing to do.

That is why, for instance, the main capacity margin is provided with combustion turbine units and why the Demand/Supply Plan incorporates CTUs for that purpose, to shorten the lead time to allow achieving a 24 per cent reserve margin.

The presence of base load longer lead time units is to allow lower energy costs, and of course, it does have capacity. But, to simplify the discussion, it's there for low energy.

When operating or when formulating a plan to add onto the existing system, what you do is you are attempting to balance the benefits of low cost capacity for reliability and low cost energy for energy production to get a system which meets all of your objectives.

MR. CHAPMAN: Excuse me one moment.

Those are all the questions I have on nuclear forecasting. I have some other areas I wish to go into.

THE CHAIRMAN: Perhaps we will take the morning break now. 15 minutes.

MR. CHAPMAN: If it is convenient, fine.

---Recess at 11:27 a.m.

---On resuming at 11:45 a.m.

THE CHAIRMAN: Mr. Chapman.

MR. CHAPMAN: Q. I have a few other of Hydro's forecasts to go over, and these documents are not in the binder, Mr. Chairman, they were distributed this morning. The first one is Interrogatory 2.2.20, and it deals with another type of forecast, but nevertheless Hydro's forecast dealing with annual acid gas production. Do you have that before you?

MR. BARRIE: A. Yes.

Q. And on the second page of this document, we see that the forecast years on the left-hand column and the forecasted years across the top, and it's apparent from looking at this document -- and the actuals, I should add, are in bold type, and the figures we are talking about here are acid gas emissions, and the figure is a thousand tonnes, the unit. Is that correct?

A. Yes.

Q. In all the years - '86, '87, '88, '89, and '90 - the actuals are higher than the forecast, except in '90; is that correct?

A. The actual is higher than?

Q. What was forecast?

A. Yes, that's generally correct.

Q. All right. And I understand - and correct me if I am wrong - that the reason that the 1990 figure wasn't higher was because there were massive imports of power from the United States?

A. Purchases were made in 1990 to reduce acid gas emissions, yes.

Q. Do you know how much acid gas was produced in the United States for the 1990 power imports into Ontario?

A. We do not know precisely how much acid gas was produced by the imported power, because, as I have explained in previous testimony, when we purchase, we do not know the specific stations that produce the electricity we are purchasing.

Q. So, you don't have an estimate of that figure?

A. We have attempted to provide a rough estimate--

Q. Yes?

A. --of the likely emissions that were caused by the purchases, yes. But I want to caution you, before we start, that it is a rough estimate.

Q. When you say you have -- was that an undertaking you gave to someone?

A. I believe we provided that in

response to an interrogatory.

Q. All right. That's fine.

Do you know what it was?

A. What the interrogatory was?

Q. What the answer was.

THE CHAIRMAN: No, what the rough estimate was.

MR. CHAPMAN: Q. Just a rough estimate.

MR. BARRIE: A. We estimated that, on balance, the imports were likely to have contributed a similar amount of acid gas as if we had generated them ourselves. Some 7.7 terawatthours were imported for acid gas, and we estimated that that was approximately 60 gigagrams or 60,000 tonnes of acid gas.

Q. And the reason for that, of course, was so that Ontario Hydro was able to comply with its Ministry of the Environment regulation passed under the Environmental Protection Act?

A. We made the purchases so that we would be within the law, yes.

Q. So that you would be within your total limits?

A. Yes.

Q. And you would agree with me, sir, that, leaving aside for a moment the situation of the

Americans, and we all know it is an international problem, but because of the flow of air in the summertime, which is, generally speaking, from the west/southwest, that a lot of this would come right back on Ontario people and our lakes and rivers and forests. Isn't that right?

A. Some of it would, but I don't know how much.

Q. It just seems to me -- well, what's your view on it? Here we have the Province of Ontario attempting to limit the production of acid gas, and we have a situation where Ontario Hydro, in attempting to meet the limits, are purchasing electricity from a neighbourhood jurisdiction, and some of the production results in acid gas coming right back on Ontario. Does that seem proper to you?

A. We took a number of control actions to be within the law in 1990. You can regard the purchases as being the very last one we took, and it was necessary to meet the law.

MR. SNELSON: A. It is not the basis on which we plan the system in the long run.

Q. No, I know that.

But the environment suffers either way, doesn't it?

MR. BARRIE: A. The global environment will suffer, yes.

MR. SNELSON: A. I trust that you are also giving us credit for the acid gas emissions that result from power that we produced in previous years to export to the United States, which presumably it is part of -- and this way of counting is presumably part of their emissions and not part of ours.

Q. Yes, I understand that.

Let's go to the export situation. And this is 2.2.27; again, one of the -- in each case, Mr. Chairman, should I be making -- when I refer to these interrogatories, I suppose I should be asking for an exhibit number?

...

[11:51 a.m.] THE CHAIRMAN: Well, no, we haven't been making interrogatories as exhibits, because they are already part of the record as interrogatories. So, unless it's a particularly large document that's used a lot - like, I think, 148, was it? - an interrogatory that's also an exhibit.

But, generally speaking, an interrogatory response has not been made an exhibit, because it can be found through reference to the interrogatories.

MR. CHAPMAN: Thank you.

Q. Now, the next document, as I indicated, 2.2.7, and this is the export forecast, another one of Hydro's forecasts; is that correct?

MR. BARRIE: A. Yes.

Q. And looking at page 2, we are talking about exports in terawatthours. And I would just ask you to look at '89 and '90. In 1989 and 1990, the actuals are again in the bold type, and it is obvious that it was anticipated that Hydro would be exporting a lot more power than, in fact, they did export; isn't that correct?

A. Yes.

Q. Now, the next document I wish to refer to is 2.2.26. It's an annual import forecast, imports in terawatthours. And here I am looking again

at, in particular, in 1989 and 1990. Actuals, in bold type at the bottom, for 1989 were 7,363; for 1990, 13,762.

So we have a situation again where I am suggesting the forecast is way off, and there were a lot more imports than had been forecasted; isn't that correct?

A. Yes.

Just to get the units right, you said these are terawatthours, so it's 13.7, not 13,000.

Q. I'm sorry. Yes, thank you.

DR. CONNELL: Excuse me, could I just clarify that?

Mr. Barrie, a few moments ago you gave a figure of 7.7 terawatthours, I thought that was 1990, was I mistaken?

MR. BARRIE: No, that's correct. The figure I gave of 7.7 was that portion of the imports that were due to acid gas restrictions.

DR. CONNELL: Thank you.

MR. BARRIE: This a total figure.

DR. CONNELL: Thank you.

MR. CHAPMAN: Q. Now, the next document I wish to refer to is 2.2.28, and it's Hydro's forecast, the annual forecast for fossil production.

2.2.28. Do you have that document?

MR. BARRIE: A. Yes.

Q. And again, the bold type at the bottom of the column indicates the actuals, the real world?

A. Yes.

Q. And we see that, almost invariably, the actuals compared to Hydro's forecast were far apart?

A. Sorry, say again?

Q. Were quite far apart?

A. We are talking about...

Q. The actuals for 1989.

A. The actual for '89 is very close to what was forecast in 1988 for '89. It's considerably more than was previously forecast in the previous years, yes.

Q. Quite a lot more in the previous years, isn't it?

A. Yes.

Q. And isn't it a fact that all these forecasts I have just gone over are related to the problems that Hydro has had with forecasting nuclear production?

A. That is a major contributor to all of

the forecasts, the differences in forecast and actuals.

MR. SNELSON: A. Another major contributor is that the load in 1990 was considerably higher than it was forecast to be three or four years prior to that. That was another significant contributor.

All the forecasts you are looking at are forecasts that are particularly sensitive to uncertainties in the other forecasts, because they tend to be the marginal things that happen. Any differences in hydraulic energy production, nuclear energy production or load, all tend to show up as differences in fossil energy production imports and exports.

So, if fossil energy production is forecast to be, say, 20 per cent of system energy production, and the other forecasts are off by 10 per cent, then the fossil energy production may well be off by 50 per cent, because it's a small proportion of the total energy.

So, forecasting uncertainties tend to show up as an exaggerated proportion of the forecasts of imports/exports and fossil energy production.

Q. But you do agree that a lot of the problems that these forecasts point out, go back to the problems with forecasting with respect to nuclear?

A. They go back to forecasting nuclear energy production and forecasting load, and in some of the earlier years, to a lesser extent, the forecasting of hydraulic energy production.

MR. TABOREK: A. Mr. Chapman, if I may, we have pointed out this phenomenon since the day the acid gas control program was announced in January of 1991, and we have specifically designed our acid gas control program to deal with that reality.

Q. Now, I have some questions, I am going into a different area now, and can you tell me generally, how much spare capacity does the existing transmission system have? For example, how long could the existing system - I am talking about the transmission system - meet the needs of Hydro's customers, if their needs, first of all, say, they increased by 5 per cent per year?

MR. BARRIE: A. You can't treat transmission as you treat generation as a certain percentage. Transmission is specific to the area and the function that that particular piece of equipment is carrying out.

Q. So, that question really can't be answered?

MR. SNELSON: A. Not in percentage

terms. There are a series of upgrades to the transmission system which are at various stages of planning, design and construction, and the people who are more knowledgeable on transmission will be appearing on Panel 7.

Q. I was also going to ask about spare capacity on the existing distribution system.

THE CHAIRMAN: By the "distribution system," you mean...?

MR. CHAPMAN: The distribution system, I mean, from the time it gets to the local hydros until it gets to the consumers?

MR. BARRIE: I defined the distribution system in my direct evidence, Mr. Chairman. The local municipalities is one example. Hydro has its own distribution system. Any equipment below 50,000 volts is defined as the distribution system.

THE CHAIRMAN: But you are talking about going to the municipal utilities, is that what you are talking about?

MR. CHAPMAN: And from thence to the consumers, the distribution until the final user.

Q. My question is: If the needs of the customers increased by 5 per cent per year, would the present distribution system be adequate?

MR. BARRIE: A. You would have you would have to refer that to the MEA, I would think.

Q. All right. Now, isn't it fair to say that the greater Toronto area consumes a large amount of the electricity that Hydro produces?

A. Yes.

THE CHAIRMAN: By "greater Toronto" you mean Metropolitan Toronto?

MR. CHAPMAN: Let me take Metro. Thank you, Mr. Chairman.

Q. Let's use Metropolitan Toronto. Can you give the panel an estimate of the percentage of the power that is consumed in Metro?

MR. SNELSON: A. I don't think we have that figure with us, but if you refer to figure 7-5 of the Demand/Supply Plan Report, it does have it by Ontario Hydro region, and central region is Toronto and some surrounding communities, and that central region uses about 46 per cent of the electricity used in Ontario.

Q. And a large portion of that would be Metropolitan Toronto, wouldn't it?

A. A large portion of that is Metropolitan Toronto.

Q. Again, if we just take Metropolitan

Toronto, how much power is produced in Metropolitan Toronto? We have a situation where it's the largest user; my question is, how much - within the Metropolitan Toronto area - how much electricity is produced in it?

MR. BARRIE: A. There is only Lakeview generating station currently operating within the Metropolitan Toronto area.

Q. Does Hydro try to locate generating facilities near to Metro to minimize transmission distances?

MR. SNELSON: A. Ontario Hydro tries to find the best location of generating stations and proximity to load is, of course, one of those considerations.

Other considerations will be things like the environmental impact of building a station in a particular area, and a variety of other technical and economic considerations. But proximity to load is one of those considerations.

Q. All right. And one of the reasons, I take it, is that if you minimize the transmission distance, you minimize transmission losses?

A. Other things being equal, yes.

Q. But transmission losses are a factor

that have to be taken into account, aren't they?

A. Quite definitely.

Q. What about distribution losses, again they --

THE CHAIRMAN: What do you mean by "distribution losses"?

MR. CHAPMAN: We were talking about distribution that was defined today, from the time it leaves Hydro and goes into the local utilities, until it goes into the final user's home.

MR. SNELSON: Basically, by losses we refer to the electrical energy which is produced by the generating stations, but is lost before it gets delivered to the ultimate customer, and it usually ends up as heat in conductors and in transformers and other equipment. So, that energy is lost, because the conductors and so on are not perfect in the transmission and distribution system.

MR. CHAPMAN: Q. Is Hydro able to estimate the total transmission and distribution losses from plants outside Metro, serving Metro? Are we talking about as much as 20 per cent, or are we talking less than that?

MR. BARRIE: A. I have got a figure for the total transmission losses.

Q. For the whole province?

A. Yes.

Q. What is that figure?

A. It's currently about 4 per cent of the total load.

Q. Four per cent of the total load is lost through transmission?

A. Yes.

THE CHAIRMAN: That's 4 per cent of what is generated; is that right?

...

[12:08 p.m.] MR. BARRIE: Yes.

MS. PATTERSON: Does that include distribution losses?

MR. BARRIE: No.

MR. CHAPMAN: Q. Just transmission until is gets to the local Hydros?

MR. BARRIE: A. Yes. In general, we do not have statistics on the local Hydro. Our job is to supply the bulk supply points.

Q. I see.

A. So, we tend not to have statistics on that.

MR. SNELSON: A. We do have an estimate, though, of distribution losses, and I believe it will be discussed in Panel 3 relative to avoided cost.

And to give you an idea of the approximate size, it is about the same as the transmission losses, maybe a little higher. So, in total, transmission and distribution might be about nine per cent or something like that.

Q. And that is --

A. That is right to within plus or minus a per cent or so.

Q. And isn't it a fact that a lot of that has to do with the distances that are travelled?

A. The transmission part has a significant component of distance associated with it. The distribution part is related to distance but in a different way.

Q. Could you explain that?

A. Yes. The more densely populated an area, then generally, the shorter is the distribution distance from some transformer to the user. And this is working from general principles. One would expect the distribution losses to be somewhat higher in rural areas than urban areas.

Q. Right. So, if we are talking about four per cent transmission and four per cent distribution, we are talking about a lot of power, aren't we?

A. Yes.

Q. In fact, if we did away with those losses, it would be the equivalent of an entire nuclear reactor?

MR. BARRIE: A. It would be a miracle as well. (Laughter)

Q. Well, you say it would be a miracle. I am suggesting that if electricity was generated on a more local basis - we are not talking about miracles, we are just talking about physics - there would be a

lot less loss, wouldn't there?

A. You can reduce it, yes. You said, "do away with it."

Q. Reduce it, to a great extent.

A. You can reduce it; the transmission portion we are talking about as well.

Q. Now, if you have a unit that produces electricity and simultaneously produces heat, you call it a cogenerator, don't you?

MR. SNELSON: A. Yes.

Q. Now, my information is that Energy Probe owns a little building in the residential part of Toronto and it has a cogenerator in itself basement, which I understand will soon be hooked up to the grid.

And this is powered by a Fiat car engine - that is what powers it - and I understand it can be serviced by a neighborhood mechanic.

And by the way, all car engines are cogenerators because they provide electricity and they provide power, don't they, to turn the wheels?

A. In the car?

Q. Yes.

A. I guess, if you want to stretch that definition that far, you can say that.

Q. All right. Now, I further understand

that Energy Probe could be generating enough electricity to meet all of its needs and to have some left over.

I understand that in the United States, there are many shopping centres, hospitals, apartment complexes, and other facilities that cogenerate electricity; are you aware of that?

A. I am aware that there are some cogeneration facilities in the United States, being commercial facilities, yes.

Q. What about in apartments and shopping centres, the like of that?

A. When I said commercial facilities, I was speaking broadly.

Q. All right. Are you familiar with all the types of cogeneration going on inside the United States?

A. Not in detail. We are getting towards the area of non-utility generation, which will be dealt with in Panel 5.

Q. So, someone else at Hydro who will be appearing on another panel will be more familiar with that, of course?

A. Panel 5 is the panel to deal with generation of electricity by people other than Ontario

Hydro. And cogeneration is one of the principal technologies that we expect others to use.

Q. All right. Now getting back to the situation with Energy Probe. When and if they have a surplus of electricity, suppose they wanted to sell their excess to their next-door neighbour?

A. To their next-door neighbour?

Q. Yes. And isn't it a fact that under the existing rules, laws, policies, that Ontario Hydro has the power to forbid, prevent, Energy Probe from selling to its neighbour; isn't that correct?

A. I am not sure I am in the position to interpret the existing law.

Q. All right. Well, do you think that Energy Probe will be met with any problems if they sell to their neighbour without going through Hydro and its policies? I am suggesting that that is not the case.

A. I am not sure of the situation you are referring to.

Q. All right.

A. In this situation, I presume you are a customer of Toronto Hydro.

Q. That's correct.

A. And there are --

Q. They are.

A. There are fairly complicated policies and so on that affect the non-utility generation that might occur inside municipal utilities. And Panel 5 is more knowledgeable on that than I am. I have no knowledge of your particular circumstances of Energy Probe and their cogeneration unit.

Q. All right. Well, let me put it this way: If the rules were changed to allow any buyer and any seller to get together, I suggest that there might be so much neighbour-to-neighbour power generated that the existing distribution system could be adequate for a long time to come -- if there were a lot of cogenerators buying and selling to each other, free access to the grid.

A. Well, there are a number of institutional arrangements that can support cogeneration by customers. And one arrangement is the one you describe where arrangements are made from one customer to generate power and he arranges to sell power to another customer.

The same net effect can be produced by the person who wishes to generate, providing power to Ontario Hydro or the local municipal utility, and the person who wishes to use power, taking power from the local municipal utility.

And theoretically, both arrangements are possible. In practice, the former arrangement has some difficulties, in that it is necessary to manage the utility's transmission and distribution system to ensure there is adequate capacity for all users.

So, in the case of wheeling, which is the sort of arrangement you are talking about - and I believe we were talking about wheeling yesterday - in the case of wheeling arrangements, they have to be coordinated with the overall design and operation of the public power system, so as not to reduce the use of the system for the other customers of the system. They can interact. So, that process has to be managed.

Q. But insofar as the price is concerned--

A. As far as what price is concerned?

Q. The price is concerned.

A. Yes.

Q. --isn't it a fact that Hydro controls the price?

A. At present, Ontario Hydro publishes a buy-back rate for small power.

Q. Yes.

A. I am not familiar with whether that prevents a municipal utility establishing a buy-back

rate that is different.

Q. All right. But it would prevent a private producer from selling to someone else or selling to Hydro. There is a fixed price that Hydro offers and that is the only price there is?

A. There are some limited arrangements for wheeling, and as I have said, Panel 5 will be more knowledgeable about it.

Q. All right.

A. We certainly permit wheeling by a single customer from one premise that he owns to another premise that he owns, but there are restrictions placed on some of the wheeling transactions, and Panel 5 would be more knowledgeable on that.

Q. Now, I also understand that in the State of Texas, which is one of the larger petroleum-refining centres in the United States, there is produced 4,000 megawatts of cogenerated power. Now, that is equivalent to about eight Pickering-size reactors; is that correct?

A. 4,000 megawatts would be equivalent to eight 500 megawatt units, yes.

Q. And my question is this: We have a city in Ontario, and it is Sarnia, and there is a

tremendous amount of petroleum refining that goes on there. There is a lot of heat going right up the stacks. In fact, when you drive through Chemical Valley, you see nothing but flames shooting up in the air.

I put it to you that if the petroleum companies in Sarnia follow the example of the situation in Texas that I just told you about, then there would be enough power for Sarnia to possibly export to neighbouring communities.

That is a possibility, isn't it?

A. The cogeneration from the potential for heat use is addressed in Panel 5. It is one of the non-utility generation technologies that we are relying upon.

I think you have to be a bit careful in comparisons between Sarnia, a small petroleum-refining region of Ontario, and Texas, which is a large oil-and-gas-producing region of the United States. And I doubt that they are strictly comparable.

Q. All right. Excuse me a moment, please.

Just before I leave transmission, I am going to turn now to a health concern. And there are many studies that indicate that high voltage

transmission lines and other power lines can cause leukaemia and other cancers.

You are aware of those, you are aware of that controversy, aren't you, Ms. Ryan?

MS. RYAN: A. Yes.

Q. And, in fact, in December of 1990, the United States Environmental Protection Agency released a 460-page report that concluded that electro-magnetic fields at certainly extremely low frequencies might be causing high cancer rates.

Are you familiar with that report?

A. Yes.

Q. In early February of 1991, a University of Southern California study funded by an industry group known as the Electric Power Research Institute, they released a report. And the Wall Street Journal on February the 8th, 1991, wrote:

> "Preliminary results of a major new study have added evidence that proximity to electric transmission wires may increase the risk of childhood leukaemia."

And my question is: Is Hydro aware of the February 1991 report?

A. Ontario Hydro is well aware of the

work that is being done on electric and magnetic effects and, in fact, is participating quite vigorously in the ongoing projects and research that are being carried out.

In fact, as has been pointed out in the State of the Environment report for 1989, which was Exhibit 21, we are participating in a number of studies with other organizations, such as Hydro Quebec, Electricite de France and EPRI, the Electric Power Research Institute.

...

[12:22 p.m.] I believe our position at this time is that a health risk has not been demonstrated, and that is the consensus of the scientific community. But, there is also agreement that there is a great need for more research to better define the concern, and so we are participating in the work.

I think that Panel 7 will have the expertise to provide more detail on the specific studies themselves, if, in fact, it is required.

Q. But you would agree with me that the studies that have come down the line so far certainly indicate that there is a possibility that there is a health problem, wouldn't you?

A. That there is a possibility, yes; that's why they are continuing with the research.

Q. And if we are talking in particular about the possibility of a health problem with transmission lines, then it may well be something that we should take into consideration when deciding what is going to be happening with the way we generate electricity and the places we generate it in the Province of Ontario for the next 25 years?

A. I believe that is already a consideration in where we generate and where we put transmission lines.

MR. SNELSON: A. Ontario Hydro's position on the biological effects of electro-magnetic fields is given in answer to Interrogatory 2.6.27.

THE CHAIRMAN: Point 27, did you say?

MR. SNELSON: Yes, point 27.

MR. CHAPMAN: Q. Now I am not intending to go into nuclear waste in any detail, because I know I am going to be met with the answer that those with expertise are coming along in other panels, but there are a few questions that I would like to ask at this time.

First of all, how many metric tonnes of high level radioactive waste is in Hydro's possession at the present time?

THE CHAIRMAN: Did you say "high level"?

MR. CHAPMAN: High level.

THE CHAIRMAN: What do you mean by that?

MR. CHAPMAN: Spent fuel.

THE CHAIRMAN: How many metric tonnes of spent fuel? Is that the question?

MR. CHAPMAN: Yes.

MS. RYAN: Just a minute.

MR. CHAPMAN: Q. Thank you, Ms. Ryan.

MS. RYAN: A. I should point out that, at this point in time, used fuel is not classified as a

waste; it's used fuel in storage until a determination on disposal has been determined.

Q. All right. It's still called "used fuel," you are saying?

A. Yes.

MR. SNELSON: A. I believe the numbers have been given in answer to Interrogatory 2.9.4. I haven't looked it up, but my notes seem to suggest that that is where you will find it.

MS. RYAN: A. I believe that 2.9.4 gives you the amount, but it is expressed in terms of fuel bundles, not tonnes.

Q. Do you have a figure in tonnes?

A. I have it in my reference material.

Q. I don't want to take the time of the panel. Possibly I can get that from Mrs. Formusa, if the figure is available. Maybe I should have had the figure at my fingertips.

A. To the end of 1990, we, in fact, have 14,350 tonnes in storage at the site where it was produced.

Q. At the site where it was produced?

A. For our generating stations, yes.

Q. And it's being stored in pools of water; is that correct?

A. At this point in time, all storage except -- I will make one exception, but in general principle, all storage is in water-filled bays. The one exception is a test of a new type of facility at Pickering, where there is a small test being carried out.

Q. What is that test?

A. It's a dry storage container still on Pickering site.

Q. And how much used fuel is being tested there?

A. I don't know that. It would be a very small amount and it's fuel that has been in water storage for a number of years, more than 6 years, so it has cooled considerably. But I don't know the exact amount.

Q. Other than that test site, the rest is being stored in -- how did you describe it? Water-filled --

A. Water-filled bays.

Q. Water-filled bays.

And I understand that, in the fullness of time, it is Hydro's intention to take it out of the water-filled bays and put it into concrete containers; is that correct?

A. That is one of the alternatives being looked at. A decision has not yet been made.

Q. And everyone agrees, I put it to you, that this waste must be disposed of permanently sometime?

A. The used fuel management plan that is now being finalized is looking at the alternatives for the future handling of used fuel, and at this time Ontario Hydro is supporting the Canadian Used Fuel Management Program, in participation with the AECL, Atomic Energy of Canada Limited, which is going towards a disposal. However, that does not mean that other storage and management options are not being retained.

Q. Now this program that you just mentioned, is it so far along now that there has been a decision made as to how this waste is definitely going to be permanently disposed of?

A. Not to my knowledge, no.

Q. And if it was, you would know about it, I put it to you, wouldn't you?

A. I would think so.

Q. Yes.

Is Hydro aware of any anticipated date in the future when there will be a final decision made, as to how and where to permanently dispose of this waste?

A. There have, in fact, been estimates of when that might be possible, but I think at this point I would refer you to Panel 9, who are more familiar with the used fuel management plan.

Q. Haven't you, in your background, had experience with radioactive waste, in your position with Hydro?

A. How do you mean "experience"?

Q. Well, I am suggesting that you are quite knowledgeable about radioactive waste, because of your experience and training - your training, your education, and your experience at Hydro. I suppose my question, I should put it this way, is there someone who knows more about radioactive waste on the nuclear panel than you do?

A. There are many more people who do have specific knowledge on nuclear waste. My background and my position at this point in time is corporate overview, so I am to maintain an overview of the broader picture.

However, when you get right into the specific technical details of used-fuel management and used-radioactive-waste management, there are a lot of technical details and a lot of people working on it. And Panel 9 will have people who are specifically in

nuclear generation division and working in that area full time.

Q. But, I take it, you wouldn't disagree when I suggest that this waste presents a serious health hazard to human beings if they are close to it?

A. I would agree that if it is not properly managed, then there could be serious problems. And that is why Ontario Hydro has programs in place to properly manage it.

Q. And this management would have to comply with radiological protection principles?

A. That is correct.

Q. It would have to preserve the quality of the natural environment.

A. That would be the intention.

Q. It would have to minimize, as far as possible, any impact on future generations?

A. Yes.

Q. And the phases of the management of radioactive waste, I suggest, include collection, assessment, processing, treatment, transportation, storage and disposal. Would you agree with that?

I will go over it again, if you want me to: collection, assessment, processing, treatment, transportation, storage and disposal.

A. I would agree that ultimately disposal is the goal. I am not in agreement that, at this stage, we have defined what that means.

Q. I'm sorry, I missed that. Ontario Hydro hasn't defined what "disposal" means? Is that what you said? I missed it.

A. What I meant was that, obviously, disposal would be the ultimate, final goal. I don't believe that an option for disposal has yet been agreed to.

Q. Agreed to, by whom?

A. Agreed to by the various parties within Ontario who are participating in it, in finding a methodology.

Q. To put it another way, there has been no final decision made on what to do with it?

A. That's correct. Until such a decision is made, it will be managed in a responsible way, continue to be.

Q. Yes.

Excuse me a moment. The next area I would like to go into is the question of Hydro's record as it relates to environmental offences, and offences in regard to health and safety in the workplace - conviction record, and record generally.

And the first document I wish to refer to is 2.2.4. It's in the bound volume, Mr. Chairman. And the question was: Please provide a list of all convictions registered against Hydro or outstanding charges against Hydro, relating to the health and safety of Hydro workers from 1970 to the present time.

And the response was a listing of convictions from 1985 to 1990 under the Ontario Health and Safety Act. And the following pages refer to that record.

And at the outset, I am familiar with this legislation because I happen to be a lawyer, but it's a defence to charges under either the environmental legislation or the Ontario Health and Safety Act; in other words, workers' safety legislation.

...

[12:40 p.m.] It's a defence if Ontario Hydro took all reasonable care. Are you aware of that?

A. For environmental, I am aware, yes.

Q. And the same is true of health and safety legislation, reasonable care is a defence?

A. I will take your word for it, yes.

THE CHAIRMAN: Do we know? Is it absolute liability, due diligence? You are saying they are due diligence defences, is that what you are saying?

MR. CHAPMAN: Yes, sir.

THE CHAIRMAN: Because I don't know for sure whether it is not.

MR. CHAPMAN: Yes, I prosecute for the Ministry; they are strict liability defences.

THE CHAIRMAN: Strict liability, rather than absolute liability.

MR. CHAPMAN: That's right. Strict liability so, therefore, there is a defence open to the accused to show that he was -- due diligence is a defence. He doesn't have to show it anymore that...

Q. Have you examined these documents? Does this represent Hydro's record?

MS. RYAN: A. This record was prepared for us in response to the interrogatory by our legal

department.

Q. All right. So, there have been several convictions; isn't that correct?

A. As listed, yes.

Q. Now, I wish to refer to the next interrogatory, which is 2.2.5. This was a request for all orders issued to Ontario Hydro, by any government organization, relating to the health and safety of Hydro's workers. The response was that all orders to comply are issued to the locations where the infractions took place, and Ontario Hydro does not keep a central file on this information.

The answer further goes on to say, there can be over 200 such orders to comply per year.

Now, my understanding of an order to comply is, it's the government. Because the situation isn't right, it comes in and orders the corporation to do something to make it safer for the workers; is that what your understanding is?

A. Yes, you are referring to health and safety legislation for worker safety--

Q. Yes.

A. --and that is not my area of expertise and I am not familiar with that legislation.

Q. All right. Now, the next document I

wish to refer to is Interrogatory No. 2.2.6, and the question was a request for convictions for environmental offences, and the request was from 1970 until the present time. The interesting response - although in fairness to Hydro, they attached a list of convictions - it said:

> "Convictions and penalties and control orders from the 1970s and early 1980s are not relevant to the Demand/Supply Plan since environmental requirements, station operations and hence, environmental performance, have changed considerably since then."

Well, the Water Resources Act and the Ontario Environmental Protection Act were in force before 1980. My question is: Why does Hydro say that their convictions for either health and safety offences or for environmental offences, are not relevant if they were before 1985?

A. Our belief was that the past five years would give you the most relevant information with regard to our operating practices that might be projected for planning purposes.

Q. And have you examined the offences listed on the second page for convictions?

A. I have reviewed the list as it is, yes.

Q. And that is Hydro's record of what the convictions were?

A. Again, it was prepared for us by our legal department, and that is the list.

Q. I don't see any dates, but I do see at the top it says, Regulatory Charges Since 1985.

I would leave it up to you, Mr. Chairman, but it's my respectful submission that Hydro should be obliged to provide a complete answer to that interrogatory and, in fact, provide all convictions of offences under either environmental legislation or Occupational Health and Safety legislation from 1980 until the present time. And I would like an undertaking from Hydro in that record. It's my submission that it is relevant.

THE CHAIRMAN: Mrs. Formusa?

MRS. FORMUSA: Firstly, this is a matter that, in my submission, should have been raised on Motions Day, with respect to disputed interrogatories, as, clearly, Mr. Chapman disputes the answer that we gave at that time.

However, we did not do so, and now we are faced with the question of the relevancy of records of

conviction, environmental offences, health and safety breaches for the past 10-year period.

The question that I have in terms of the onus that Mr. Chapman must satisfy, with respect to the relevancy of this material to the Demand/Supply Plan, is that there is a lot of information that could be made available with respect to those matters.

And when we looked at it, we were unable to determine - except in the sense of giving the panel an idea of the kinds of convictions, at least, over the past five years, the number of convictions in these areas - how further information would be of assistance, with respect to the issues in the Demand/Supply Plan. It was for that reason that we relied upon the information for the past five years as indicative of the kinds of experience we have had in the operation of our existing system.

I think the answer that's provided is the answer that I would rely upon today with respect to the kinds of environmental requirements that we might anticipate in the future. The last five years, I think, is a good representation of that.

Things may become more stringent, accidents will no doubt happen. It's a question of how are we managing the existing system, have we got

appropriate controls in place for certain areas.

I think it's appropriate if there is a concern that a particular area or type of facility or option poses significant, or any, concern with respect to health and safety, or breaches of the law, then those matters can be addressed with respect to each option.

I think that that's what the parties have been doing with respect to both the operation of the existing system, the issues that they have raised there, and issues that I expect will be raised with respect to future options and the regulations that would have to be met.

We have taken the position, and I believe it's in Chapter 4, with respect to health and safety matters and worker safety, that we do work to meet the law and that public and worker safety was given in the demand/supply planning strategy as one of the strategic thrusts that must be met by our future plans, and we have addressed those matters.

But I fail to see how getting into the details of past convictions over a 10-year period, without any specific assistance from Mr. Chapman, will be of usefulness to this hearing.

MS. PATTERSON: I thought it was a

20-year period.

MRS. FORMUSA: Originally, it was 20 years, but I believe he has reduced it to the last 10-year period.

MR. CHAPMAN: I would come down to 1980. I would be quite happy with that.

I'm sorry, I have interrupted, you are not finished.

MRS. FORMUSA: No. I have completed.

THE CHAIRMAN: Thank you.

Mr. Chapman, why is 1985 not good enough?

MR. CHAPMAN: Well, if your ruling, sir, is that it would be of no assistance to the Board --

THE CHAIRMAN: No, no, I am just asking you what your position on it is, in reply to Mrs. Formusa's submissions.

MR. CHAPMAN: I think it's my respectful submission that convictions under this legislation, either health and safety or environmental, is relevant because it shows the negligence of the corporation. And surely, a request such as Energy Probe made shouldn't be cut off at a certain year just because Hydro decides that that's all that's relevant.

THE CHAIRMAN: You are saying this a bad record, is that your submission?

MR. CHAPMAN: My submission is that these convictions for negligence should be taken into consideration. I am not saying whether it's a good record or a bad record, but they are examples of Hydro's negligence in conducting their operations.

MS. PATTERSON: So, it's a management issue, rather than a particular facility option issue?

MR. CHAPMAN: Yes. I would agree that I have no knowledge of any particular facility that is not run properly. And it is generally, I would say, the overall conduct of the corporation as it relates to (a), the environment, and (b), Hydro's workers.

THE CHAIRMAN: Why do you say this is relevant to the issues that we have to determine?

MR. CHAPMAN: Well, first of all, if these examples of negligence are such that it may well be that not as much responsibility should be left with Hydro, that's one possible outcome.

Hydro's evidence in chief, and in the Demand/Supply Plan itself, clearly indicates that they have great concern for the environment. This is an environmental assessment hearing.

It's my respectful submission that their past conduct in relation to the environment and their workers is relevant material that should be before the

Board.

THE CHAIRMAN: Okay.

---Off the record discussion.

THE CHAIRMAN: We are all of the view that the extent of the information given, the response to interrogatory, is sufficient for the purposes of the hearing.

If there are, as Mrs. Formusa points out, any specific situations, then that can be be brought up in some other way in another context.

MR. CHAPMAN: Thank you.

Q. I would like to refer you to HR 18, which is the August 30, 1989 document.

THE CHAIRMAN: Is it in the folder?

MR. CHAPMAN: Yes, it's in the binder.

THE CHAIRMAN: There are two extracts from HR 18. Which one is it that you are referring to? There is one at pages 60 to 61.

...

[12:53 p.m.] MR. CHAPMAN: Mr. Chairman, the document I am referring to, it says --

THE CHAIRMAN: And the other one is page 311 to 312?

MR. CHAPMAN: Yes, that is the document.

THE CHAIRMAN: 311 to 312?

MR. CHAPMAN: Yes. That is the one document I wish to refer to. And I think, before I get to that one, I wish to refer to the report of the Subcommittee on Acid Rain, which is found almost near the back of the binder:

Q. Is anyone on the panel familiar with --

THE CHAIRMAN: That is the federal report, is it?

MR. CHAPMAN: That's correct.

THE CHAIRMAN: The Subcommittee on Acid Rain and the Standing Committee on Fisheries for Forestry, is that the one?

MR. CHAPMAN: That's correct.

Q. Has anyone on the panel had an opportunity to examine this document?

MR. TABOREK: A. Yes, Mr. Chapman, I have. I believe I was the official who, in June '83, testified before the subcommittee in Ottawa.

Q. All right. And how long did that hearing go on?

A. Half a day -- or the hearing.

THE CHAIRMAN: That was your part of it, I take it.

MR. TABOREK: My part was half a day.

MR. CHAPMAN: Q. Yes?

MR. TABOREK: A. Typically, this went on sporadically over a long period of time, perhaps a month or so.

Q. All right.

THE CHAIRMAN: But you don't really know how long it went on, do you?

MR. TABOREK: It is my recollection, sir, but you are quite right.

THE CHAIRMAN: Okay.

MR. CHAPMAN: Q. And this document is the report that came out of that hearing, isn't it?

MR. TABOREK: A. Yes.

Q. And it refers specifically to Ontario Hydro and the problems with acid gas emissions; isn't that correct?

A. Yes.

Q. And it also refers to the corporate strategy designed to meet those limits at that time; is

that correct?

A. Yes.

Q. Now, at the bottom of page 22, it indicates:

"A number of events starting in the summer of 1983 have led the subcommittee to question the feasibility of Ontario Hydro's strategy."

Now, what strategy was the subcommittee referring to?

A. It is necessary to look at three points.

Q. Yes?

A. That the strategy is to meet an objective; the objective is the regulation imposed on us.

THE CHAIRMAN: I am sorry, would you just...

MR. TABOREK: The strategy is to meet an objective, and the objective is the regulation imposed on us. The regulation was a provincial cap expressed in total tonnes of emissions on the output from our fossil plants, and Ms. Ryan described those limits to you earlier.

The province allocated this number to us

after an assessment of costs and benefits of reducing to various levels and we developed a response to stay within that limit at least cost.

We put in place a hierarchy of measures which fell into three broad categories: One, to reduce the use of coal; two, to use lower sulphur fuels for the remaining coal in use; and three was to fit control equipment to our generating stations.

MR. CHAPMAN: Q. Scrubbers?

MR. TABOREK: A. And low NOx burners and other devices. And within those broad categories, there are multiple options and we had a long list of options to be used in order of least cost.

We developed this strategy because we had to fit changing load and changing conditions on our nuclear hydraulic stations within a fixed emission limit, so we developed a flexible least cost strategy.

Q. All right. And this report is quite critical of Ontario Hydro, isn't it?

A. Yes.

Q. And it seems to suggest generally that Ontario Hydro's attitude toward reducing its acid gas emissions left a lot to be desired?

A. I discussed this situation at some length with Mr. Irwin who is the Chairman of the

committee. As I understand it, he had an alternative approach in mind: Instead of dealing with a fixed tonnage cap, Mr. Irwin seemed to be wishing to minimize emissions wherever they occurred. Instead of considering costs and benefits, Mr. Irwin placed most of his emphasis on the benefits and very little on cost. And he similarly wished a firm committed program that would be invariant.

He was a very uncomfortable when we added new elements to our program to meet changing circumstances. In particular, he was extremely interested in having scrubbers fitted on all of our stations. And we felt that this was considerably less cost effective than the regulation that the province had faced, put on us, and that we were meeting.

Q. So, oftentimes in these matters, there is a weighing that has to be done; on the one hand, the costs of reducing the emissions of acid gas; on the other hand, the effect on the natural environment; isn't that correct?

A. Yes.

Q. And it was Hydro's original intention to install scrubbers quite early in the 1980s, wasn't it - announced intention?

A. That's correct. With the conditions

that we were forecasting in 1981, we would have put two scrubbers in as part of the least cost package to meet the conditions of '81. In 1986, they would have gone in.

In 1982, if you will recall, there was a significant recession, and our load forecast dropped sharply for the future. And the declining load meant that not as many measures were required to meet the fixed tonnage limit.

And another factor was, we had been planning a large export sale and those scrubbers were part of the -- if we export, we would have had to clean those exports to stay within our limit. And that export order did not come through.

So the conditions changed and our program changed to meet the conditions; again, to meet the law at the least cost.

Q. What about the environment? The way you just --

A. What do you mean, what about the environment?

Q. The way you just put it was to meet the law.

A. Yes. It is the --

Q. Do you think that there should be

some sort of corporate responsibility of Hydro to not only meet the law but to concern itself with what is happening to the natural environment because of Hydro's emissions?

A. Yes, indeed.

Q. Insofar as --

A. There is also a government responsibility. And one of the best forms of guidance that we have - and what is appropriate to meet, say, the environmental cleanliness - is the direction given to us by government.

Q. Well, isn't it a fact, sir, that it was necessary for the government of the Province of Ontario to pass a regulation to control your emissions of acid gas?

A. Yes. It is normal to implement controls to pass regulations to specify them.

Q. Well, you correct me if I am wrong, but I have been in the business quite a while and I only know of about four or five in the entire province - four or five industries in the entire province, where it was necessary to pass a piece of legislation, a regulation to control their emissions.

There are hundreds and hundreds and hundreds of control orders from which there is an

appeal - but you correct me if I am wrong - I know about Falconbridge. I know about INCO. I know about Hydro's. I am talking about government regulations to control their emissions.

Do you know --

A. There is also another regulation that covers, in effect, emissions from all other coal-fired plants, so that, really, all coal-fired sources in the province are governed by regulation, as I understand it.

MS. RYAN: A. If I could just add to that: I believe the ones you have covered, in fact, make up about 75 per cent of the acid gas emissions in Ontario. And those caps were set not just to control the industries for which the regulations were set, but to meet a Canadian requirement and an international requirement for capping and stepping down acid gas emissions.

So, the regulation within Ontario was set, No. 1, to improve environmental quality, but also to ensure that international protocols, which also have the goal of protecting environmental quality, were met.

Q. All right.

MR. TABOREK: A. And the reason four were chosen was because the provincial government also

used the same approach we did; namely, define the targeted we wish to meet and then select the least-cost way of meeting it.

And the least-cost way of meeting it was to allocate the reductions it required among those four companies that you identified, plus some other minor items that were dealt with in a separate fashion.

THE CHAIRMAN: Perhaps we can now adjourn until 2:30.

---Luncheon recess at 1:05 p.m.

...

---On resuming 2:35 p.m.

THE CHAIRMAN: Mr. Chapman.

MR. CHAPMAN: Thank you, Mr. Chairman.

Q. The last document I would like to refer you to is the HR 18, the report of the Ontario Energy Board, and the page numbers are 311 and 312. It is an excerpt from the Energy Board's report. And that was in my bound volume.

THE CHAIRMAN: It is in the black binder. Do you have it?

MR. SNELSON: We have a pile of documents. We don't have a black binder.

THE CHAIRMAN: Mrs. Formusa has it for you now.

MR. CHAPMAN: Q. Mr. Taborek, you have had an opportunity to read this document, this portion of the document?

MR. TABOREK: A. No, I haven't. If you will just gave me a minute, please.

THE CHAIRMAN: Is it 14.3.3 you want them to read?

MR. CHAPMAN: Yes, please.

MR. TABOREK: Yes, I have read it.

MR. CHAPMAN: Q. And it is obvious from reading that that the Energy Board considered Hydro's

plan of dealing with acid gas emission limits by purchasing in the U.S. wasn't proper, didn't it? That was what the Board said?

The second paragraph:

"The Board considers this approach in dealing with emissions shortsighted, parochial, and not in the spirit of international cooperation on acid gas abatement."

A. Yes.

Q. That was the opinion of the Board?

A. Yes.

Q. Is Ontario Hydro the largest emitter of carbon dioxide in Canada?

A. Carbon dioxide?

Q. Yes, carbon dioxide.

A. But this is SO(2).

Q. I am talking now about carbon dioxide.

A. I don't know.

MR. SNELSON: A. There is data on this in Exhibit 40.

Q. And is Ontario Hydro the second largest of emitter acid gas in Canada?

MR. TABOREK: A. Yes.

THE CHAIRMAN: Just out of interest, who is the largest?

MR. CHAPMAN: Inco, I understand.

MR. TABOREK: Inco.

MR. CHAPMAN: Q. Now Hydro knew in 1981 that there was a government concern about acid rain; isn't that correct?

MR. TABOREK: A. Yes.

Q. And Hydro knew the criticism in 1984 of the federal government standing committee that we referred to earlier?

A. Yes. And we considered the federal committee's criticism not valid.

Q. And scrubbers are one method of controlling the emissions of acid gas; isn't that correct?

A. Yes, they are one method.

Q. And many U.S. power plants have installed scrubbers to control acid gas in the past, haven't they?

A. Correct.

Q. In 1983, Hydro realized that Pickering had developed pressure tube problems; isn't that correct?

A. Yes.

Q. And Hydro still didn't take immediate steps to have scrubbers installed, I suggest, even though the corporation realized that the nuclear problems would necessitate more fossil-fuel generation and the emission of more acid gas?

A. On the contrary. At any point in time, we had options arranged in order of least cost to reduce emissions to within limits at least cost in the range of circumstances that could hit us.

And in the period you are mentioning, in the early '80s, the nuclear performance was very good, it was better than expected. And if you look at your data on fossil requirements, in the early '80s, the fossil requirements were less in actual than we were forecasting.

And we also recognize problems with nuclear units, incidentally, problems which we had expected, which we had warned various committees about, including the committee that the previous evidence was about. We had incorporated into our strategy mechanisms of meeting the acid gas limit at least cost in the face of those contingencies.

I wonder if I might borrow Ms. Ryan's exhibit from her direct, page 14 from her direct, which, in effect, shows our performance over the past

decade, and I think it is quite clear our performance has been good. We have met the law in every year. And we have done so in the least-cost manner possible.

Now you are referring to the fact that in 1990, we used the method that, well, people didn't like and we didn't like, quite frankly.

Q. It would have been a nice time --

A. The reason we didn't like it, I would say, is not because it harmed the environment, because the difference between our producing and the Americans' producing, it is difficult to find any at all. We recognized that it would present a problem to people.

So, the environment was not harmed, we met the law, we met our environmental obligations. While we were meeting our obligations to provide reliable electricity at least cost, we did so meeting problems with the nuclear units that we had forecast and planned for, and we did so while providing, I believe, for a 60 per cent growth in the use of electricity over this same period.

So, I think what this is is an illustration that, over that ten-year period, we accomplished a very difficult objective, together with a number of other very difficult objectives on the reliability on the low cost side. And the closest we

came to difficulty was in one year we had to buy.

But, I would also point out to you, in all those other years in this period, we had sold to the Americans. And if it is a problem in one year, then we have one year of slight negative and nine years of slight positives on that regard. So, I think our performance in meeting our acid gas challenge has been very good.

Q. So, you don't think there is anything wrong with Hydro's conduct other the years from 1981 to 1991 with respect to the emission of acid gas?

A. Anything wrong?

Q. Yes.

A. Could you be more precise, please?

Q. Corporately wrong.

A. I think we have met our objectives, period.

Q. To this day, has there been one scrubber installed?

A. No, not to this day; there has not been a scrubber installed because we have not yet gone through our options to reach the point where that level of cost is called for. To this point in time, the least-cost options have been to utilize the nuclear plants which were coming on line. And then the next

option was to reduce the sulphur level in the coal, and I am grouping options a bit simply here.

And it is after those options have been exercised, and the regulatory limit has been dropped, that scrubbers become economic, if they are placed on high capacity factor plants with a reasonably long life ahead of them. And so the scrubbers come in as an economic option in 1994.

Q. Is that when your first scrubber will be installed and working?

A. That is correct.

MR. CHAPMAN: Those are all my questions.

THE CHAIRMAN: Thank you, Mr. Chapman.

DR. CONNELL: I have two follow-up questions. Just on the issue of purchase from the U.S., I just put it to you that if you examine the patterns of generation in the United States, before, during, and after the time of a particular purchase, is it possible to draw inferences about where the incremental generation took place?

MR. TABOREK: Yes. Simply speaking, yes, and I am anticipating your question. But precisely, no; but generally, yes.

DR. CONNELL: And it would be possible, then, to draw some general inferences about whether it

was coming from a high acid gas site or a low acid gas site.

MR. TABOREK: Mr. Barrie has made some estimates of the emissions that would have been released in the U.S. And was it 60,000 tonnes, Dave?

MR. BARRIE: Yes.

I think it's true, a general inference is a reasonable way to put it. The difficulty one has is trying to assess not only where did you purchase electricity from, but what would have happened had you not made that purchase.

One can actually argue that occasionally you can buy -- if we buy some electricity from a plant that was dirty, if we had not bought that, would that plant have been on anywhere? Would someone else have bought it? Perhaps someone in New England who was going to run an oil-fired plant might have bought that fossil plant.

So, in fact, your buying prevented them buying, and you could have, in fact, displaced oil plant. It's a very tortuous argument to find out specifically the result of your action of purchasing.

MR. TABOREK: We have gone on further, Dr. Connell, and we have attempted to estimate the difference in the depositions in the sensitive areas,

if we were to generate in our plants, compared to the Americans generating the same amount of electricity in their plants.

And there are, essentially, three factors that come into that analysis. One is the prevailing winds, because you are looking at the impact on the receptor. The other is the type of coal that would be used. And the third is the distance, since depositions tend to be a function of distance. And allowing for the sort of crudeness of estimates that come into this sort of thing, the best we could see, it was a wash.

The second point to bear in mind in judging this is that -- we are talking about changes of the order of 60,000 tonnes. Officials of the Ministry of the Environment have testified before legislature hearings, and I have discussed this with them, that differences of 100,000 tonnes in one year are undetectable.

Furthermore, in some years when Inco has been on strike and Inco was producing close to a million tonnes, the Ministry had set up very sensitive detectors around Inco to measure the before-and-after effects of this large fraction of a million tonnes, and it was barely detectable. And the detections were some improvement and some deterioration as a result.

So that what you are looking at on environmental impact - and not to minimize the environmental aspect - but there is not a direct environmental impact of those levels of changes.

DR. CONNELL: My attention wasn't really focused on the deposition, but just on the generation. So, just leaving out of consideration the factors of distance and wind direction that you cited, the nature of the fuel would, of course, be a factor. But, I think it would be useful to have any insight that you are able to give us, as long as it is not too complex. Any brief summary of experience that would illuminate the question, I think that would be useful.

MR. SNELSON: Exactly what question is it you are asking at this stage?

DR. CONNELL: My question is, in practice, whether - let us focus on 1990 - you can put before us some plausible inferences about the acid gas emission of an incremental nature, due to the U.S. purchases.

MR. SNELSON: I believe, Mr. Barrie gave you an estimate that it was about the same as if we had generated the power ourselves, and it would represent about 60,000 tonnes.

DR. CONNELL: I'm sorry, I looked that

up, yes.

MR. SNELSON: So, I am not sure whether we can undertake to provide anything additional, or whether anything additional is required.

DR. CONNELL: I will look at that.

My other question just concerned the discussion of transmission. I presume that there are losses in transformers as well as linear transmission; is that correct?

MR. SNELSON: That's correct.

MR. BARRIE: Yes.

DR. CONNELL: Do we have any understanding of the relative proportions?

MR. SNELSON: I have just been reviewing some interrogatories that IPPSO is going to be referring to, and it has some breakdown of the losses. I can't give you it directly, but it is partly transformers and partly lines.

DR. CONNELL: Yes.

And my other question. Could you corroborate my conviction that for a given quantum of energy at a given distance, that transmission losses are roughly inversely proportional to the voltage?

...

[2:50 p.m.] That is, the higher the voltage, the lower the losses, all other factors being equal?

MR. SNELSON: If you transmit a given amount of power, then, at a lower voltage, the losses -- that the current is increased. So, if the amount of power that is transmitted is at half the voltage, then the current is twice as high.

Now, if you still have the same size of conductor, the losses would be four times higher. But, in point of fact, the systems are arranged so that the large transmission lines, the bulk power lines, carry large amount of powers at high voltage. And the distribution lines --.there are many of them and they are divided up many ways.

So, I don't believe it is possible to make a rule of thumb that at lower voltage, the losses are lower than at higher voltage.

DR. CONNELL: Per unit?

MR. SNELSON: Per unit, no, I don't believe you can make that rule of thumb.

DR. CONNELL: Thank you.

THE CHAIRMAN: Any further questions?

MR. CHAPMAN: No, I have nothing.

THE CHAIRMAN: Thank you, Mr. Chapman.

Mr. Chapman, I take it that anything in

this black book that wasn't referred to and is not an interrogatory is not considered to be part of the evidence in this hearing. Would that be proper way to deal with the black book?

MR. CHAPMAN: That is correct.

THE CHAIRMAN: Thank you.

MS. PATTERSON: Shall we keep it?

MR. CHAPMAN: We will be introducing it through the appropriate panels when they come along.

THE CHAIRMAN: You might need it for other panels, do you think?

MR. CHAPMAN: Yes.

THE CHAIRMAN: So, we shall keep this book, is that right?

MR. CHAPMAN: Yes, please.

MRS. FORMUSA: Mr. Chairman, I wonder if if I might make reference to an interrogatory that might be helpful to Dr. Connell on the acid gas.

THE CHAIRMAN: Yes.

MRS. FORMUSA: 2.14.68, I don't think Mr. Barrie mentioned it, but it contains an analysis. You recall that was one of the ones... I think Mr. Shepherd probably has got it in his package of materials.

In the answer, there was a small analysis

done of purchases and that's where the figure of 6.6 is referenced. And since we have been talking around it, I thought that it might be helpful if you took a look at the supplementary information we filed with respect to that.

THE CHAIRMAN: Thank you.

MR. SHEPHERD: Good afternoon, Mr. Chairman.

Mr. Chairman, before launching into this, perhaps I could get the business out of the way.

I have five exhibits that I would like to file. Since I know I am going to referring to all of them, maybe it is just as easy if I file all five at once. There are in a package that I have given to Ms. Morrison, they are all quite short. I will read them into the record, if you would like.

THE CHAIRMAN: Yes, that is fine.

MR. SHEPHERD: The first which will be Exhibit 158 is entitled "Overheads to be used in IPPSO Panel 2 Cross-Examination."

The second, which I guess will be Exhibit 159, is entitled "Excerpts from Operating Licence for Bruce Nuclear Generating Station "B" and from Operating Policies and Principles," et cetera, et cetera.

THE CHAIRMAN: Dated August 1989.

MR. SHEPHERD: Dated August 1989.

The third, which I believe will be Exhibit 160, is dated 1988, is entitled "Excerpts from Documentation for the Delta Computer Program Set-Up."

The fourth, which is Exhibit 161, is entitled "Excerpts from Electricity Appendices Report," dated October 1990.

And the fifth, which I believe will be 162, is dated May 29th, 1991, and is entitled "Effects of Unit Size on Reliability."

And while this is the only one that has any thickness to it, you will note that the text is actually a page and a bit, and the rest is all numbers.

---EXHIBIT NO. 158: Overheads to be used in IPPSO Panel 2 Cross-Examination.

---EXHIBIT NO. 159: Excerpts from Operating Licence for Bruce Nuclear Generating Station "B" and from Operating Policies and Principles, dated August 1989.

---EXHIBIT NO. 160: Excerpts from Documentation for the Delta Computer Program Setup, dated 1988.

---EXHIBIT NO. 161: Excerpts from Electricity Appendices Report, dated October 1990.

---EXHIBIT NO. 162: Effects of Unit Size on Reliability, dated May 29, 1991.

MR. SHEPHERD: I have also provided a package of interrogatories that we intend to refer to, which I believe - now this was done about one a.m., so

I am only half sure of it - I believe is in the order that we are going to be referring to them. And I won't refer to them now, simply to say that, as I refer to them, they should be next on top of the pile. I have given some copies to Ms. Morrison for the Panel.

MS. MORRISON: Could you give me the name of Exhibit 161 again? It doesn't appear to be in my package.

MR. SHEPHERD: Exhibit 161 is entitled "Excerpts from Electricity Appendices Report," by the California Energy Commission. It may have gotten stuck to the previous one. They are both pretty thin. They are both one-page exhibits.

MS. MORRISON: Okay.

MR. SHEPHERD: And one other thing, I would like to apologize to the witnesses. We did not anticipate, I guess, being on until tomorrow and so, as a result, they were only provided with these exhibits just shortly before the lunch break. It was intended that that's when they would be provided for them, but that they would have a day in advance to look at them. I apologize for that. It was not intentional.

I would also like to introduce Mr. William Marcus, who is sitting beside me, who I guess is well-known to most of the panel members and to

Ontario Hydro, as an energy economist who works out of California. A former staff member with the California Energy Commission, I should add.

Mr. Chairman, our cross-examination can be loosely dividend into two areas. In the first, we will be dealing with a number of operational and reliability issues, and unfortunately, many of those issues are mainly for the purpose of laying ground work for questions on future panels, so it may be a tad dry.

In the second area, we will be dealing with the overall environmental policy and compliance of Ontario Hydro.

However, before dealing with those two things, I do have to spend just a few minutes on something raised by Mr. Snelson's direct evidence last Tuesday, and this is to do with the bandwidth being used by the planners today.

CROSS-EXAMINATION BY MR. SHEPHERD:

Q. I understood you to say last Tuesday, Mr. Snelson, that with the changes made to the load forecast in the 1990 load forecast, you are now planning, that is, the planners are using, if you like, the new median and the old upper and lower bounds of the load forecast; is that correct?

MR. SNELSON: A. We are using the new

median basic load forecast and the new upper and lower bounds of the basic load forecast.

Q. The new?

A. Sorry, the new median load forecast and the old upper and lower bounds of the basic load forecast.

THE CHAIRMAN: And by the "old" you mean the DSP?

MR. SNELSON: The DSP, yes.

MR. SHEPHERD: Q. I am showing you an overhead, this is page 1 of Exhibit 158, that is the median, upper and lower bounds taken out of the DSP. Now, this is the basic load you originally planned to meet; isn't that right?

MR. SNELSON: A. I haven't checked the numbers on your figure, but the basic load that is in the DSP is the basic load forecast I was referring to.

Q. So, subject to check, this is what you plan to?

A. Yes.

Q. Now, I am showing a second overhead, which is No. 2 of that package. And am I correct that this is the median, upper and lower bounds from the 1990 load forecast, as amended by Mr. Burke in Volume 11 of the transcript?

A. I haven't had an opportunity to the check these figures, and so I can accept it, subject to checking, but I can't confirm it in a definitive way.

Q. Would you accept it, subject to checking?

A. Yes.

Q. I am going to have quite of number of numbers in this. And maybe we should leave it that I am going to ask you to confirm things and you are going to accept them, subject to check, and then if I turn out to have done the math wrong, you can tell me tomorrow morning. Is that okay?

A. Yes.

Q. Or after the break.

A. Well, I am not sure it will be tomorrow morning, it may be Monday morning, but...

Q. That's okay.

I should, just as an aside, my practice in Panel 1 was to advise you, Mr. Chairman, of how long I expected to be. I do not expect to be finished by the end of the day tomorrow, unless the panel of witnesses talks very fast.

THE CHAIRMAN: And not as volubly, I suppose. (Laughter)

MR. SHEPHERD: This is Panel 2, not Panel

1, so I think we're safe there. (Laughter)

THE CHAIRMAN: Let me make sure I understand. These upper -- on figure No. 2 of Exhibit 158, are the upper and lower bandwidth as in the DSP adjusted because of the evidence that Mr. Burke gave in Panel 1?

MR. SHEPHERD: No, Mr. Chairman. This is the numbers from 1990 load forecast, which is post-DSP, then adjusted by Mr. Burke's testimony.

THE CHAIRMAN: I'm sorry. Okay.

MR. SHEPHERD: Q. I am now showing a third overhead, and assuming that the numbers on the first two are right, will you confirm that these three lines, which are actually not all solid lines, even though they look like it, are the median, upper and lower bounds that you have just said your planning is planning to meet today, right now?

MR. SNELSON: A. Well, I can check it against the overhead I used, which was very similar to that.

Q. I should tell you that all I have done is taken the middle line off the second chart and upper and lower lines off the first chart. So, unless my computer program isn't working right, it should be correct.

A. It should be correct.

Apart from the fact that figure you have appears to be to an expanded scale with a suppressed zero, it looks very similar to the one which I used in my direct evidence.

Q. All of these graphs are on the same scale though, are they not? It is not misleading to put them all to the same scale, is it?

A. I have a personal dislike of graphs with suppressed zeros because they give distortions of perspective. But if you wish to read the numbers accurately off graphs, then it is an acceptable practice.

Q. I am, in fact, going to refer to the specific numbers anyway, so maybe we can get around that.

I don't know whether you have the numbers here - and perhaps you could tell me if you do - am I right in saying that the difference between the median and the upper bound for year 2014 was -- and I will give you three numbers: 4900 megawatts in the DSP; 9660 megawatts in the amended 1990 load forecast, that is, amended by Mr. Burke; and is now, for planning purposes, 1880 megawatts. That's the difference between median and upper, the year 2014.

Do those figures sound about right?

A. This is the difference between -- we are looking at this figure, right? There is one difference between median and upper in this figure, right?

Q. That's right, which is 1880.

A. Which is the 1880.

Q. Now, on Chart 1, it would have been 4900; is that correct?

A. Part of my direct evidence was that that the new median is closer to the upper bound of the old load forecast than the old median was.

Q. We will get into why you did it in a second. I am just asking, are the numbers right?

A. Again, it will be subject to checking.

Q. But it sounds about the right range?

A. It's much grosser, yes.

Q. Now, I am going to show you a further overhead, No. 4, which just overlays the two on top of each other. Does this give a good representation of the comparison of the old to the new, aside from the fact that my printing is bad?

A. I haven't had an opportunity to plot the latest revision that Mr. Burke gave, which I

believe affected the width, the bandwidth post-2009 or -2110, just about the last five years, and I understand that was in the direction of widening the bands.

Q. Yes.

Subject to that caveat, does this look about right?

...

[3:05 p.m.] A. It is probably about right. I would have to check them, but it is not a picture I wouldn't expect.

Q. I will tell you that if you wish to check them, and it is easier for you, we can give you the spreadsheet to look at and you can cross-check it against the numbers.

A. That would be useful.

Q. Now I would like to read you a couple of quotes. First from Exhibit 9, page 11 - and you don't need to turn it up, unless you particularly want to. This is the 1990 load forecast and it says:

"Given the sources of external uncertainty in addition to the uncertainty attached to the load forecasting process itself, the necessity for care in the use of the load forecast cannot be overstressed. The load forecast cannot be used as only a single line projection. The sources and consequent ranges of forecast error must be considered as well.

"For this reason --"

- and this is underlined in the text -

"For this reason, the probability

distribution associated with the median forecast is as important as its central tendency."

Now, Mr. Burke says in Volume 12 of the transcript, at page 2107 - and again, you needn't turn it up, unless you particularly want to:

"Planners should be taking into account the range of results possible for load in their planning."

And he says again, in Volume 8 at page 1412:

"The forecast is the median and a range. They are not separable."

It appears clear from these quotes, that, in the view of your forecasters, the median and the upper and lower bounds are a single forecast. They are attached together; you can't separate them. And they should only be used by a planner that way; is that right?

A. Mr. Burke is certainly putting a lot of weight on the range and we, too, put a lot of weight on planning for a range of circumstances.

Q. Well, I don't understand how you can pick the median from one forecast and the upper and lower bounds from another forecast and somehow put them

together. That isn't what he was saying you could do, is it?

A. If you were to be starting fresh today, you would probably use the current estimate of this uncertainty range. You have got a situation, though, that the plan provides a certain amount of flexibility to cover upper and lower load growth circumstances.

And if you look at this figure, we judged that, up until about 2005, the difference in the ranges was not particularly significant; and that beyond 2005, there was a significant trend towards a higher load growth in the upper and new forecast, but that was something we didn't necessarily have to build into our plans today.

Q. All right. Why didn't you have to build it into your plans today? I am not sure I understand that.

A. Provided we have made provision up until 2005 - and for that the problem occurs increasingly as you move from 2005 to 2014 - then you will have some time to respond. And I will give you a couple of ways: The upper of the load forecast tends to determine the amount of approvals that are requested in this procedure, because we are seeking enough

approvals to be able to cover the upper load forecast. And if we have underestimated the upper load forecast, then the amount of approvals that we are seeking won't last as long.

So, for instance, our rationale in deciding how much approvals to seek was that we wanted to have enough approval so we didn't have to go through a process like this for another five years.

Now, if the load forecast is tracking on the upper and the bands as forecast in three or four years from now look as Mr. Burke currently has them, then maybe we have to initiate a process like this sooner rather than later, so, to cover off the possibility of increased loads beyond, say, 2006 or 2007. So, we felt that this was still an adequate representation to define what approvals we would need.

Q. So, it is sort of a planning judgment? I mean, you can't just keep on changing your plan every time you turn around, right?

A. It is a planning judgment.

Q. But I guess there's some implications to it, as well, are there not? And I am going to refer you to Mr. Burke's testimony, where he said that, mathematically, an 80 per cent confidence band, which is -- that is your load forecast bandwidth normally,

right?

A. Yes.

Q. 80 per cent -- is 1.3 standard deviations about the mean. And that means, of course, 2.6 standard deviations about the mean, if you include both sides; is that correct?

A. I am taking his mathematics. I know you can express it as a ratio. It doesn't sound wrong.

Q. All right. Now, his current total year 2014 bandwidth is 17,560 megawatts. I will ask you just to accept that, subject to check.

A. Is that the difference between the old lower and the new upper?

Q. No. That is new lower and the new upper.

A. New lower and new upper.

Q. And if you divide that by 2.6, the number of standard deviations, you get the amount of a single standard deviation about the mean, which is 6,750 megawatts? This is all fairly simple math, I think.

Now, assuming that that is the amount of one standard deviation about the mean of this load forecast, am I right that your current planning difference on the upper side - that is, between the

upper and the median numbers - 1880 megawatts is .28 standard deviations, 1880 divided by 6750.

A. You can do arithmetic, I presume, yes.

Q. Not everybody would give me credit for that.

Now, there is, in fact -- I will ask you, is there a chart or a standard relating standard deviations to levels of probability; is that fair? It is in the back of every statistics text?

A. Yes, if you are talking about the normal probability distribution.

Q. And again, subject to check, would you agree that there is only an 11 per cent probability that the load will fall between the median you are using and the upper bound that you are using?

A. It will be a smaller proportion and subject to check.

Q. And there is, in fact, a 39 per cent probability, on Mr. Burke's testimony, that load will be above the upper bound you are currently planning to?

A. I am presuming you have looked up the tables correctly.

Q. And if you do the same calculations for the lower bound, you would find that there is a 42

per cent probability that load will fall within the bandwidth you are currently using - that is, between median and lower - and an 8 per cent probability that it will be outside of your bandwidth; is that --

A. That is probably the case.

Q. Looks about right.

Now, I am going to show you another overhead, which is page 5. And this just does those calculations and, then, in fact, calculates - and please feel free to check this - the probability of your plan being either inside or outside the bandwidth that you are currently planning to.

And based on Mr. Burke's testimony, it would appear that there is approximately a 53 per cent chance that load will be within the bandwidth you are planning to, and a 47 per cent chance that it will be outside of the bandwidth you are planning to; is that correct?

A. You have done these calculations for 2014, which is the very end of the planning period. I would prefer you to focus on the 2005-or-thereabouts period of the plan, which I believe is the more relevant period to be doing these sorts of calculations.

Q. I am going to come to that in a

second, Mr. Snelson.

But just let me be sure I understand this. You originally had a plan which was good for 80 futures out of every 100, in effect. And now you have a plan which is good for 53 futures out of every 100; is that fair?

A. For the situation as it exists in 2014. 2014 is only one year of the 25-year planning period and is one of the less significant years.

The decisions that we are making are far more relevant to the situation in the sort of 2000-to-2010 period.

Q. Agreed. Let me just put No. 4 back up for a second. As, I guess, you pointed out and, certainly, eyeballing it myself, it looked like the old and new bounds start to diverge, especially on the upper side, about 12 years out. Twelve years from now, they start to diverge fairly significantly - 12 or 13, say.

A. 2004, yes.

Q. Okay.

A. Yes, that is the first point it starts to be significant and it gets increasingly significant beyond that.

Q. Now, that seems close to the planning

lead time you need for a nuclear station right now; isn't that right?

A. Yes.

Q. Sort of the same range of years.

Maybe this is just a leap of logic that I am not entitled to make. It would seem to me that if you had to plan for the real upper bound, the upper bound that is now Hydro's official upper bound, instead of the old one, am I right in assuming that the logical thing to do might well be to get approval for another nuclear station if you are going to need it about then?

A. I think you would have to consider what your options were, if you were to be seeking additional resources at that time. It could be more nuclear plant. It could have some other type of plant. It could be an advancement of things that are within the plant.

Q. Now, you talk about the question of whether you would have to come back for approvals, sooner rather than later, which, presumably, is not something that you are looking forward to a great deal.

Do you currently have any plans, or are any plans currently under discussion, to amend the approvals sought in this process to add further to nuclear capacity approvals to deal with the new upper

bound?

A. Not to my knowledge.

Q. I want to turn now to the operational issues.

DR. CONNELL: Does that conclude that?

MR. SHEPHERD: That concludes that.

DR. CONNELL: If I could just ask a supplementary question?

MR. SHEPHERD: Sure.

DR. CONNELL: If I could just ask Mr. Snelson: It is a hypothetical, I am afraid, but if the new median had happened to fall outside the upper band at 2014, would you have taken any different view?

MR. SNELSON: We would have had to consider it very, very carefully, even more carefully than we did in coming to this conclusion.

If it was outside in one year, and it was not a particularly significant year, we may have still made the same decision. But I think it would have been a much much more difficult decision to make, and it may have been necessary to introduce a change.

MR. SHEPHERD: Q. This series of questions deals with the notion of economic dispatch and technical constraints on economic dispatch.

I guess this is your area, Mr. Taborek,

or Mr. Barrie?

MR. TABOREK: A. Mr. Barrie.

Q. Do I correctly understand your earlier evidence, Mr. Barrie, to be that subject to technical and other non-cost constraints, you attempt to dispatch the system by adding the capacity or the energy with the cheapest production costs, correct?

MR. BARRIE: A. Yes.

Q. That is the notion of economic dispatch?

A. We attempt to dispatch generation 24 hours a day, so that over that period, we minimize overall production costs, yes.

Q. Well, I take it this means you try to minimize the marginal fuel plus the variable O&M costs, right? You aren't trying to affect the fixed O&M or the capital costs at all because they are already sunk anyway, correct?

A. Correct. The way we dispatch on an hour-by-hour basis is we use marginal costing tables.

Q. Yes.

A. And marginal costing tables have only fuel and the marginal portion of OM&A.

...

[3:20 p.m.] Q. And that's referred to elsewhere as the variable OM&A, is that correct--

A. I'm not sure.

Q. --or is that a different concept?

A. I think it is the same concept, yes.

MR. SNELSON: A. Yes.

Q. And economic dispatch is limited by a number of physical and technical factors, some of which you have gone into; right?

MR. BARRIE: A. Yes.

Q. So, you have said that some units can't run below a certain minimum capacity?

A. That's correct.

Q. If you could just turn up -- I am going to be using this interrogatory for a number of things. Maybe you could just turn up 2.14.9, Interrogatory 2.14.9. And I guess most of the things I am going to want to talk about are on Table 1A and Table 1B of that interrogatory, which is the third and fourth pages up.

So, for example, your minimum capacity for Lambton which is a -- no, that's wrong. Wait a second. For Lakeview 3 and 4, for example, the minimum capacity is 55 and the installed capacity is 284.

A. Yes.

Q. Is there a minimum capacity for nuclear units typically?

A. Yes.

Q. Can you give us an idea of what it is?

A. It is considerably more than this.

With a nuclear unit, it's somewhat different, what you can physically do. This is an absolute minimum at Lakeview here; you cannot go below.

On the nuclear units, we are normally restricted by the extent of the manoeuvering on a nightly basis. So, we have shallow manoeuvres and deep manoeuvres, but normally, we are not manoeuvering down below about 80 per cent. But the unit could physically go below that, but that would not be a normal operation.

MR. SNELSON: A. It can physically go below that if you take it down slowly and bring it back slowly.

Q. Is there a real minimum? Like a hard minimum like at Lakeview? Or is it if you take it down slowly enough, you can take it down to 1 megawatt and it might not be efficient but you could do it?

A. I don't know of a real minimum, but I think it's a hypothetical question, because the

situation doesn't often arise on the system. The real situations that arise are that 95 per cent or more of the time. You want to run your nuclear units all the time.

Q. That's an economic dispatch decision?

A. That's an economic dispatch decision.

And then occasionally, during night-times and weekends, when the load is not very high, then you may have times you want to reduce nuclear output further. And you can take units down by some proportion - and Mr. Barrie probably has that - and then still bring it back up the next day because of certain physical constraints. And that's not a very deep manoeuvre.

You can take units off for a weekend and put them back on again on the Monday. That is done occasionally. So there is a variety of manoeuvres.

MR. BARRIE: A. We don't know what the minimum is.

Q. Okay. That's fair enough.

MR. SNELSON: A. But it is not an important system constraint.

MR. BARRIE: A. The reason I don't know is we never have to use them.

Q. Now this 80 per cent number you used,

that is sort of the logical or the normal maximum manoeuvering that you would do on nuclear; right?

A. That is what could be typically done on an overnight, when the rate at which you can reduce and then the rate at which you can pick up. You have, say, an 8-hour period overnight, which would be, that would be the kind of level you could get down to because of the ramping down and ramping up restrictions.

Q. I am going to come back to ramp rates in a second. But you often don't even go down to 80 though; right?

A. We very rarely do this at all.

Q. Normally, you just run your nuclear flat out, because it is the cheapest?

A. That's correct.

Q. Okay. One of the implications of that, I guess, is that if you need another 10 megawatts, you just can't switch these units on and off; right? Whether it's nuclear or fossil--

A. Well, that's right.

Q. --it's just not feasible. You have to have something going that you can move up or down and manoeuvre it.

A. For nuclear and fossil, you cannot

put them on and take them off to reach another 10 megawatts, or another 100 megawatts, for that matter. You have to have plants synchronized and ready to pick up load.

The only exception -- hydraulic you can put on quicker.

Q. And that is because of storage; right?

A. Pardon?

Q. That's because of storage?

A. Well, hydraulic, by its very nature, can pick up load quickly, whether it is actually on or whether it is ready to come on. And combustion turbines would be another one that can come on quickly.

Q. Yes, of course.

A. But the two big ones you talk about, nuclear and fossil, you are correct.

Q. Now let's go to ramp rates.

You were just describing that briefly. Do I understand that ramp rates are the rates at which you can take a unit up or down in output?

A. Yes.

Q. And if you look again at Table 1A, you will see ramp rates, that's the fifth last line, these are for your fossil units, of 6 megawatts per

minute. And I take it that means -- I'm just doing the calculations. How long does it take you to take - I can't do the math in my head - let's say, Lakeview, up from zero to full capacity?

A. 6 into 266.

Q. 6 into 266? Sorry, Lakeview 5/6, okay.

A. You are looking at three-quarters of an hour, something like that.

Q. So, it is about 45 minutes.

A. In fact, it actually happens quicker than that. When you are loading a machine from zero, you would tend to put more load on quickly at the beginning. That ramp rate is more typically the pick-up rate one could expect when moving from, say, three-quarter load up to full load.

Q. So, it is actually faster.

A. From zero to full load, would be somewhat faster than that, but I don't know the exact number. One tends to put a fair amount of megawatts onto a machine fairly quickly at the beginning, quicker than this.

Q. That seems like an awful short time to get a fossil unit up fully. My understanding is that the sort of norm around North America would be

closer to 3 or 4 hours from zero to full capacity.

A. Oh, well, we have to define what we are talking about here. This is talking about the rate of pick-up of load of the generator from the time the generator is synchronized. So, we are not counting all the time it takes to prepare the boiler, which can be hours, as you say.

Q. But if you have it operating -- let's say, you take one of these units, Lakeview 5/6, for example, it's operating at its minimum, 55 megawatts, at night, and you want to bring it up in the morning?

A. Yes.

Q. You are only talking about 30 or 40 minutes?

A. Yes.

Q. Okay. Now, in practice, does that mean that, typically, in low load periods, you won't switch off thermal units?

A. There is a mixture. When we take a machine off overnight, we call that "two shifting." It means the machine is running for two of the three shifts of the day, which is typically from, say, seven in the morning till eleven at night.

So, as one approaches each evening period, decision has to be made as to whether the most

economic thing to do is to "two shift" plant, that is, to shut some machines down or whether to "part load" plant. And the result of that analysis is usually a mixture of both of those. We will shut some machines down and we will keep some machines running.

Q. Now when you make that decision, you are choosing the cheapest combination of generation, but am I right that having, let's say, Lakeview, on - Lakeview may not be actually the cheapest thing to have on at that time, but overall it makes for cheapest system operation because of things like ramp rates, et cetera?

A. We will normally -- we will always, in fact, have some machines on at Lakeview overnight, especially in the wintertime, we always keep one on, anyway, to keep the station warm. So, there are other considerations.

But we are trying to minimize overall production costs, so that result that you just said can occur, yes.

MR. SHEPHERD: Mr. Chairman, perhaps this is a time for the break.

THE CHAIRMAN: All right. Fifteen minutes.

---Recess at 3:30 p.m. ...

---On resuming at 4:47 p.m.

MRS. FORMUSA: Again, on transcript undertakings, I have a number to file for Panel 2. I spoke with Ms. Morrison and we thought we would provide copies to those parties who wanted them, and I thought it would be useful to read the numbers that we have provided to you into the record, so when parties are reading the transcript, they will know which ones are ready. I will try to do that quickly.

THE CHAIRMAN: Okay.

MRS. FORMUSA: Exhibit 142.1 through to .8 inclusive; 142.10 through to .14 inclusive; 142.15B and C.

THE CHAIRMAN: That's 15, did you say?

MRS. FORMUSA: 15B and C. 16; 18; 20 through to 28 inclusive; 36 through to 40 inclusive.

And I have only got the one set with me right now. I will give those to Ms. Morrison and then I will make sure Mr. Watson has a set. And any other parties who would like a set, I will make copies for them.

THE CHAIRMAN: They are mostly Mr. Watson's, I guess.

That means 9, 15A, 17, 19, 16, 18, 29 and 35, 25 to 35 inclusive are not answered yet.

MRS. FORMUSA: That's correct. I believe they all are for the MEA.

THE CHAIRMAN: All right. And I guess there is no one left from Energy Probe, is that correct?

There are two documents that they referred to that probably, for identification purposes, should be given exhibit numbers. They are the report of the Acid Rain Committee. What would would that be?

MS. MORRISON: 163.

THE CHAIRMAN: And the Ontario Energy Board Report, HR 18, pages 311-312, which would be 164.

---EXHIBIT NO. 163: Report of the Acid Rain Committee.

---EXHIBIT NO. 164: Ontario Energy Board Report, HR 18, pages 311-312.

THE CHAIRMAN: Perhaps could you notify Energy Probe and give them those numbers for those two documents.

MRS. FORMUSA: While we are still on those untertakings, 142.29 through to 35 will be empty. You will recall that we took a guesstimate of where we were and we thought we had 36. In fact, we had 28.

THE CHAIRMAN: So, 29 to 35 is empty.

MRS. FORMUSA: 29 to 35 will not appear. They are empty. Thank you.

THE CHAIRMAN: All right.

MR. SHEPHERD: Q. Before we leave this question of manoeuvring, I don't want to miss anything, all of your fossil units, are they all capable of two-shifting, Mr. Barrie?

MR. BARRIE: A. Yes, I think that is correct. There are certain restrictions. That is, if you two-shift a unit, say, Unit 1 at Nanticoke on a certain night, there may be a restriction you can't two-shift it the next night. So I don't want to give the impression that you can two-shift every unit every night.

Q. But you wouldn't, anyway.

A. No, we wouldn't anyway. But each unit itself is capable of two-shifting.

THE CHAIRMAN: What do you mean by "shift"?

MR. BARRIE: I'm sorry. When we shut down overnight. It is just a term that the shift operators use.

There are three shifts that make up a day, morning, afternoon and night, and so if the machine runs for two of those, morning and afternoon, it shuts down for the nightshift. So, they call that two-shifting.

THE CHAIRMAN: Are they equal 8-hour periods, or different periods?

MR. BARRIE: Yes.

MR. SHEPHERD: Q. Okay. Now, let me deal with ignition fuel. I understand this to be sort of like starting up an old-style charcoal barbecue: You have to put some sort of lighter fluid, or something like that, on it to get it to start. Isn't that true with fossil units, you have to have some sort of distillate oil to start it; you can't just start it with coal?

MR. BARRIE: A. Yes, it's not quite like a barbecue. (Laughter)

Q. Well no, I realize the analogy is inexact.

A. Just to be clear what we do. We put the oil in first, we ignite the oil, and when the ignition is established, then coal is introduced.

Q. And if you will look again at Table 1A of 2.14.9, which is the one we have been looking at, as I read that, let's just say you are looking at Lakeview 3-4, which I picked because it's one of the highest; if you start it from a cold start, you need 28,000 litres of distillate oil, right?

A. Yes.

Q. So, presumably, in many circumstances, you don't really like to shut it off and get cold, because there is an expense associated with starting it up again?

A. That's one the factors that has to be taken into account, as I said, when we are making the decision whether to two-shift or to part load, yes.

Q. Now, you have also said that there is something called minimum downtimes, and this, again, let me attempt an analogy. When you turn off your computer, you are told - at least my system's advisor tells me - you can't turn it back on again for 30 seconds, or something very bad happens, which I yet don't know what it is, but something bad happens. And that's sort of true with fossil units as well, or thermal units; isn't it?

A. Yes.

Q. Once you turn it off, you have to leave it off for a little while?

A. There is a minimum shutdown time allocated to each unit.

By the way, in your reference to cold start there, that wouldn't apply to the overnight shutdowns we have been talking about.

Q. That would be a warm start, right?

A. That would be hot start. Anything less than 16 hours is defined as a hot start.

Q. So, hot is under 16 hours, so that would be an overnight, for example. And what is warm?

A. I think it is 48, but I would have to double check that.

THE CHAIRMAN: Warm is 48?

MR. BARRIE: Yes.

MR. SHEPHERD: Q. So, that would be, for example, a weekend?

MR. BARRIE: A. Right.

Q. And then, if you had, say, a planned outage or something --

A. Then it would be a cold start.

Q. Then it would be a cold start, okay.

A. I will double check those hours. That gives the concept, anyway.

Q. Yes. Minimum downtimes aren't actually very long, are they?

I am looking again at Table 1A, we are talking about a range from six minutes for Lambton - this is the fourth last line on that page - to, if you look over the page, the longest is at Atikokan and Lennox and Thunder Bay, which are an hour. Those are minimum downtimes?

A. I think that minimum downtime is an error. The minimum downtime for somewhere like Lakeview and Lambton and Nanticoke, we measure in hours, not minutes. So, I will have to check. That seems to be an error to me.

Q. Will you check that and get back to us?

A. I will.

Q. Should we have a number for that, advising us of the correct minimum of downtimes?

A. My belief is that that's just a straightforward error. Those minutes should be hours.

Q. Probably.

A. I will undertake to -- if that's not correct, I will come back. Otherwise, it is hours.

Q. Okay. Now, in terms of minimum downtimes, nuclear is especially tricky, isn't it?

Could you describe to us the concept of poisoning-out?

A. When a unit on a nuclear unit shuts down, there is a build up of Xenon in the reactor. I am not a nuclear reactor physicist so don't question me too closely on it. I can tell you what it means to us as operators, though.

Q. It's okay. I have no idea what Xenon

is, anyway.

A. Let me just say this: The faster the machine shuts down, so if it's instantaneous trip, the buildup is quicker. After a certain amount of time, the reactor poisons-out. That is, the buildup of Xenon is such that the reactor will no longer function.

What that means is normally, on a trip, if you get the machine back quickly, it's okay. If a certain amount of time elapses - in the case of a trip, it's not very long, just a few minutes - then you cannot get the machine back, and that might be for 36 to 48 hours.

Now, on a more controlled situation, the buildup is not so fast. But what it does, in fact, do is it puts limits on how quickly you can deload the machine and then pick up -- well, how quickly you can deload the machine, basically.

Q. Now, except for planned outages, typically, a nuclear unit would never shut off except for a trip, right? In other words, it would be a forced outage, you would take it off fast?

A. There may be occasions at this time of year, in the spring when we have lots of water at the Hydro stations, where we have excess base load capacity, where the sum of the hydraulic plus the

nuclear is more than our minimum demands. If that were to last over a weekend, for instance, then under those circumstances, we may consider shutting down a nuclear machine. That would be the only instance and it would be a very rare occurrence.

So, in general, your statement is correct. I just wanted to make that one caveat.

DR. CONNELL: Mr. Barrie, the Xenon is right in the fuel?

MR. BARRIE: Yes.

DR. CONNELL: It can be flushed out in time?

MR. BARRIE: No.

DR. CONNELL: It cannot be flushed out. So, the fuel would have to actually be replaced?

MR. BARRIE: No, no. I think, actually, Mr. Snelson knows more about this than I do.

MR. SNELSON: The Xenon, I believe, is an intermediate problem in the decay of uranium, and there is a time constant with which Xenon is being created and the particular radio-nuclide of Xenon that is created has its own decay time to something else.

The Xenon itself is an absorber of neutrons, which tends to inhibit the nuclear chain reaction. And so it's a matter of time before it

decays to this other product.

And again, I am not a nuclear physicist either. But it's the balance between the exponential rate at which it's being created, and the exponential rate at which it's decaying. And an imbalance causes a buildup of Xenon which will absorb neutrons. And it will decay naturally itself to something which doesn't absorb neutrons, which permits the chain reaction to be restarted.

DR. CONNELL: Thank you.

MR. SHEPHERD: Thank you.

Q. Do you have a minimum number of units of each station that you have to have on? Is that a requirement, technical requirement?

MR. BARRIE: A. We tend to keep at least one machine on, certainly at all the fossil stations, and all the nuclear stations would have machines on anyway. Hydraulic stations, we often shut down the whole station.

Q. At the thermal stations, is that just to keep the building warm, or are there other reasons why you do that?

A. If we shut all stations down, we can get significant imbalance of power flows about the network. Overnight, that wouldn't be a major

consideration. I am not sure that there is any other reason to keep machines on.

Q. It's your normal practice, though?

A. Yes.

Q. Now, let me come to minimum up-times. Again, I am looking at Table 1A, you said under normal operation no minimum up-time is required. Can you explain that, or is it just as it seems? Is it more complicated than that?

A. I think it just means when the machine comes on, it can run indefinitely until some fault occurs, but there is no defined up-time.

Q. So, you could, in the case of these fossil units, for example, ramp them up every day for afternoon peak, and then take them off the system and ramp them up again the next day?

A. Yes. Well, I said that there are restrictions at certain stations. For part loading, certainly, yes, we could do that.

There are restrictions about actually shutting down the same unit night after night.

Q. Why is that, that you don't want to shut them on and off, turn them on and off?

...

[4:04 p.m.] A. It is putting stresses on the boiler and turbine units.

Q. When you were talking the other day - on Monday, I think - about the effects of cycling units on and off, is that what you are talking about?

A. Yes.

Q. It adds more wear and tear?

A. Yes.

Q. They don't last as long?

A. Yes.

Q. It requires more maintenance?

A. It is not established exactly what the language is, but there is certainly evidence that two-shifting does put stress on turbine boiler units and their net result will be a need for more maintenance. I think that is fair to say.

Q. Okay. Let me come then to heat rates. Am I right in understanding that one factor affecting the incremental cost of production from a unit is the heat rate? And could you describe what a heat rate is?

A. Well, a heat rate is quite simply the heat input compared to the electrical output. So, it is usually expressed in kilojoules of heat input per kilowatt of output.

Q. Is it true that, in practical terms, it is a convenient measure of how much fuel it takes to produce a unit of electricity?

A. Yes. All it does is, instead of using tonnes of coal, for instance, it puts it on a common basis because different stations use coal of different colour and value--

Q. Exactly.

A. --so, yes, it is essentially amount of fuel.

Q. So, if you have a higher heat rate, then am I right that that means that you are burning the fuel less efficiently and, as a result, it takes more fuel to produce the same electricity?

A. Yes. A high heat rate expressed in kilojoules per kilowatthour will imply a lower efficiency, yes.

Q. Okay. I am looking here at Table 1A again, and I am looking at the average heat rates which are actually in gigajoules per hour, but that is just a different measure, is it not--

A. Yes.

Q. --of the same thing - at minimum load, 25, 50, 75 and 100 per cent of capacity.

And am I right in understanding that at

the lower outputs, you have to have quite a high heat rate; it is not that efficient?

Then you get into a sort of a sweet part, if you like, of your output curve in the middle, where you burn the fuel very efficiently and then, as you push towards the top, your heat rate goes up again; you need more fuel to get each unit of electricity; is that fair?

A. Not quite. You have to distinguish between average heat rate and marginal heat rate.

Q. I am actually looking at the incremental which is similar to marginal, yes.

A. Okay. Incremental is the same as -- well, I am using it synonymously with marginal. The marginal heat rate on a unit increases as you increase load. The reason the average and the marginal are different there is taking into account that you have a certain amount of heat for no output, for zero output. So, when you take account of that, the average tends to fall as you increase; whereas the incremental will always increase.

Q. Okay. I am going to show you, then, overhead No. 6, page 6 of Exhibit 158. And in this, we just took Lambton as an example. It happened to be the one that showed the point the clearest.

And you will see that this chart takes your gigajoule per hour numbers from Table 1A and converts them into kilojoule per kilowatthour; calculates incremental heat rates, average efficiency and incremental efficiency. These are all terms you are relatively familiar with?

A. Yes. I don't know how you have calculated the incremental for the first line, though.

Q. Well, let me, then -- that actually got me all confused last night, too.

A. Oh, good.

Q. What it is, it is the heat rate for that last tranche of output; that is, from 25 to 50 or from 50 to 75 or from 75 to 100. So, it understates the marginal, but it shows the point; isn't that correct?

A. So, you are saying it is the increment from zero to 25?

Q. That's right.

A. Yes. We normally state incremental as being at the midpoint of a range. So, from nought to 25, we would take an actual -- we regard incremental as, really, the slope of the curve.

Q. Yes.

A. That is the only number I have

trouble with on your ...

Q. Okay. The only reason we have done it this way, Mr. Barrie, is because we didn't have the data to calculate the curve. So, with this number of points, we had to do is this sort of more rough and ready way.

A. I will just say that every average heat rate and incremental heat rate I have ever seen follows the basic path of what you have here, starting high and getting lower for average, but starts low and gets higher for incremental.

So, that is why I have trouble with the first number in your incremental. It is the only one that doesn't fit the standard path.

THE CHAIRMAN: I am sorry, what is MRC on the graph?

MR. SHEPHERD: Oh, sorry. MRC is maximum reliable capacity.

Q. Isn't that right, Mr. Barrie?

THE CHAIRMAN: I am sorry?

MR. SHEPHERD: Maximum reliable capacity.

MR. BARRIE: It is not a term that I would normally use. We normally put MCR.

MR. SHEPHERD: MCR, sorry.

MR. BARRIE: Maximum continuous rating.

MR. SHEPHERD: My typing error.

THE CHAIRMAN: Sorry.

MR. BARRIE: This is not my chart. We would normally use the initials MCR for 'maximum continuous rating' and we use that as our benchmark for defining different outputs from the unit. So, 100 per cent would be the full load continuous rating of the unit.

MR. SHEPHERD: Okay. That is the intended concept, Mr. Chairman.

THE CHAIRMAN: Would that be the same as capacity?

MR. BARRIE: Yes.

THE CHAIRMAN: So, rating and capacity are the same, is that right?

MR. BARRIE: Yes. I use the two words as synonymous.

THE CHAIRMAN: Okay.

MR. SHEPHERD: Q. Now, the differences in heat rates at various levels of MCR, those are obviously in your operational dispatch models, right? You consider those when you are deciding on making dispatch decisions?

MR. BARRIE: A. The incremental heat rate are the basis of our dispatch.

Q. And if you did it without that, then you wouldn't be getting the cheapest generation, would you? It wouldn't be true economic dispatch? You would just assume the average heat rate for the whole plant wherever you were on the capacity chart?

A. Oh, yes.

Q. Just as an aside, Mr. Snelson, do you know, offhand, whether these variations are in the LMSTM model?

MR. SNELSON: A. The LMSTM model has an approximation to this process which is based, I believe, on the average heat rate of units given a predicted or an -- is actually the same amount of path load and low load operation as in certain historical periods where the average heat rate was determined.

So, the heat rate was determined from experience and not from a particular point on the input/output curve that you have been looking at here.

Q. So, the LMSTM model - and I know I am getting a little into Panel 3 and I will stop in just one second - the LMSTM model then uses a fixed heat rate number rather than a variation based on a unit's output?

A. The LMSTM model uses a fixed heat rate which is chosen to have a representative amount of

path load operation and start-ups and shutdowns in it, comparable to actual historical experience with those units.

Q. Thanks a lot. I will leave the rest of that for Panel 3.

I want to talk for just a second about coal inventory. Obviously, you need to maintain a fossil-fuel inventory, Mr. Barrie. That goes without saying.

MR. BARRIE: A. Yes.

Q. I am showing you an overhead, No. 7. And this is based on your response to Interrogatory 2.14.89. This is your data. It is not our data.

Do you agree that Ontario Hydro's historical year-end coal inventory has averaged 62 per cent by volume and 63 per cent by cost of Ontario Hydro's annual generation? Does that seem right to you?

THE CHAIRMAN: Is this fossil generation or all generation?

MR. SHEPHERD: Coal generation, coal-based generation.

MR. BARRIE: The figures for the inventory seem very high. But as you say, the figures from this... It is just my first reaction at looking

at these. Maybe we can have some clarification. Are these year-end inventory or end-of-the-shipping-season inventory?

MR. SHEPHERD: Q. Year-end. I was actually going to come to that because I was -- .

MR. BARRIE: A. Okay. Year-end, end of the calendar year?

Q. Yes.

A. It is okay, yes. They seem not too bad.

Q. Okay. That is about 7-1/2 months worth of inventory.

I take it from your surprise that that is skewed because it is the end of December, which is at your high, your peak time?

A. Well, two things are occurring in December: The shipping season has ended, so we are not going to get any more coal. And we are just entering our maximum fossil burn. So, yes, we would expect these to be at the very high end of the levels that we would expect.

Q. Can you give us a rough idea of what sort of inventories on average you would carry?

A. I could tell you what our policy is and what our history has been over the last ten years.

Our policy is to aim to have about 2.8 teragrams. So, just in relation to these numbers, in 1984, where you have 8344, we would expect to have 2800.

Q. 1981, you mean?

A. Yes.

Q. You would expect 2800?

A. As of March 31st.

Q. So, this is a range of about 25 per cent of annual consumption? Give or take?

A. Yes.

Q. 90 days or so?

A. We normally burn about 10 teragrams and we aim to have about 2.8 teragrams.

Q. So, a little over 90 days of inventory?

A. I wouldn't want to express it like that, because the fossil burn is so variable throughout the day.

Q. Yes, of course.

A. So, it is probably best expressed the way you did at first; it is about 25 per cent of the annual burn.

Q. And you include the cost of maintaining this inventory in your costs associated

with your fossil units; is that correct?

A. Which costs?

Q. The costs associated with maintaining the inventory.

A. You have to be very careful. They are not included anywhere in marginal costs that we have just been describing, for instance.

Q. No. Sorry, go ahead.

A. So, I say, which costs?

Q. Those are fixed O&M costs, right?

A. Yes.

Q. So, you don't include them in your production costs--

A. Right.

Q. --for economic dispatch?

A. Yes, I guess. You said, "fixed O&M." I am not sure that we do include it in OM&A. It is a fixed cost associated with fuel.

Q. All right.

A. In the OEB, that is how it would be expressed. It would go under fuel-related costs.

Q. Okay. All right. Let me turn to some transmission issues. And we are, finally, I think, done with 2.14.9.

Could you turn to 2.14.3, Interrogatory

2.14.3, please?

Now, Mr. Barrie, I think it was you that said, on, probably, last Thursday, and I will quote. And the transcript reference, by the way, is page 2784 of Volume 16. I will quote:

> "Although we continue to closely monitor, operationally, transmission interfaces, we cannot foresee significant bottling anywhere in the province in the immediate future."

...

[4:18 p.m.] Now, this 2.14.3 is supplementary information provided by Ontario Hydro in response to that interrogatory. I haven't actually included the original answer I don't think. Am I right that this is a list of transmission bottlenecks?

A. Yes.

Q. And perhaps you could turn to page 4 of that chart just for a second. Can you describe what that chart means?

A. Page 4?

Q. Page 4.

A. The chart on page 4 is a listing of transmission system constraints that caused us to move away from a pure economic dispatch. So it caused us to put on more expensive generation than we would have done had the transmission constraint not existed.

What it is, is a listing for the four years, '87 through 1990, of the number of days that this particular limit caused us to take such action. So, it is an indication of how severe the limit is in terms of the number of times it required us to take action.

Q. Now, do I take it from your testimony that I have just quoted that these problems are all now solved?

A. In later testimony after my direct, I did run through a number of transmission initiatives that have already taken place, or will take place in the very near future, that will resolve many or all of these issues. So, yes.

Q. Okay. So, they are all, now, either solved or there are plans to solve them?

A. If you actually look at the numbers, you can see that, in 1990, it was the top five, the top five that really represented all of the occasions when action was required. And of those, the top one, FABC, was solved in November of 1990, when the transmission out at Bruce was reinforced, so that one will disappear in '91.

Q. Let me just deal with the FABC. That's flow away from the Bruce complex; right?

A. Right.

Q. You talked at some length about that.

Keep 2.14.3 up for a second, I may come back to it, but would you just look at the next interrogatory on this list, 2.14.18. Would it be easier for the witnesses if they had this package, which is in order, of the interrogatories. Would that be easier, Mrs. Formusa?

A. I have got.

MRS. FORMUSA: They have got it.

MR. SHEPHERD: Because the list we gave you was not in this order, it was in numerical order. So, if you wish this package you are welcome to it, if it's easier.

Q. Now in 2.14.18, I am just looking now at the second page of that, there is a chart that talks about Bruce locked-in energy and I am just looking at the gigawatthours. The worst year was 1987; right?

MR. BARRIE: A. Yes.

Q. Am I right that in that year you lost about 2.4 per cent of your total system production because of FABC?

A. We lost 2,912 gigawatthours, which on a hundred and twenty... Yes, I think you have got the arithmetic about right.

Q. Now you have solved that by the addition of a new transmission line; right?

A. Yes.

Q. That's the 500 kV line down to London?

A. Yes.

Q. In the interrogatory, just look at the previous page to that, it is 2.14.18. Now I have got to find it on the page. It is in the second last

paragraph, about the middle. It says:

"Locked-in nuclear generation at Bruce is expected to be minimal, occurring primarily during transmission outages or during heavy transfers from Michigan."

I am just going to ignore the latter part of that for a second. Do I read this correctly that because of the large quantity of generation at Bruce, you are still vulnerable to locked-in generation there whenever you lose transmission capacity out of the Bruce area?

A. Yes. If we have a transmission outage, especially on the 500 kV, then we will have locked-in energy at Bruce.

Q. Is it fair to say that the Bruce problem originally arose and, to the extent it is still there, it is still the result of the fact that you have a whole lot of generation centralized in one area but your load is centralized somewhere else?

A. It is caused because when Bruce was commissioned, there was inadequate transmission out of Bruce. If sufficient transmission was built out of Bruce when it was commissioned, then there would have been no locked-in energy.

Q. And is the reason why so much

transmission was required for the distance between a concentration of load and a concentration of generation?

A. Yes.

Q. Is that a generic problem on your system, that you tend not necessarily -- or as Energy Probe asked this morning, that you tend to have generation not directly proximate to load?

A. We have large concentrations of generation which require us to have major transfer capability.

Q. And am I right that over the last five years, even discounting FABC, most of the times that you have had power shortages where you have had to use emergency measures or even something slightly less, at least a significant component of those shortages has been the result of locked-in power? Is that a fair generalization?

A. It's been a factor. Were you thinking of any particular year or incident?

Q. No. I am thinking in general over the last five years.

A. We have had little use of emergency measures other than 1989 where we have made constant reference to already in this hearing. And in 1989, the

transmission restriction did have an impact, yes.

Q. You gave an example in your direct testimony of a lesser problem--

A. Yes.

Q. --right, where things just started to build up. And you have a fair number of those, don't you, or you solved the problem but it is still a problem?

A. Yes.

Q. And is it fair to say that often, more often than not, those problems have as a component locked-in energy somewhere?

A. Not locked-in energy, no. A transmission interface might be an issue when we are solving a particular problem, yes, but I don't think it is a normal regularly occurring event.

Q. I'm just going to take you back to 2.14.3. And if I read this right, for the last -- 1987 to 1990 certainly, 60 or 70 per cent of the days of the year, at least two and sometimes three or four of these transmission bottlenecks was in effect. Isn't that right?

A. Yes. The year I referred to, 1989, is the one that displays the most of them--

Q. Yes, of course.

A. --and the one that was particularly impactive on us at that time. FABC has always been there, virtually every day, but FETT, as we call it, which is the Flow East Towards Toronto is a particular interface that caused us problems during 1989. This was when we were trying to send a lot of power from the western part of Ontario to the eastern part.

So, yes, as you see, FETT was impactive on 143 days in 1989, so it was a significant factor during that period. But as you say it wasn't particularly impactive in previous years.

Q. In addition to the problem of locked-in power, you have also talked a fair bit about line and transformer and -- about transmission and transformer losses, and I guess also distribution losses.

I am not going to deal with the latter, but the transmission losses are associated with the distance between generation and load, aren't they?

A. They are associated with the distance to be transmitted and the amount of load on the line. It's directly proportional to the square of the current on the line. So, a very heavily loaded line will incur heavy losses.

Q. Now I am going to ask you to look at

Interrogatory 1.29.31, which is out of order in this pile. It is two down in the pile. 1.29.31.

This is in fact the transmission loss number and the distribution loss number that you were looking for earlier; isn't it?

A. Yes.

Q. And 6.2 terawatthours is a fair bit; right? It's what, 5 per cent of your system, 5 per cent of your energy?

A. Approximately, yes.

Q. Would I be guessing correctly if I guessed that you have to keep in generation, including reserve margin, something in the order of 8- or 900 megawatts of additional generation available to look after the problem with having those transmission losses? Does that sound like it is in the right range?

A. I think it's in the right range, yes. I would have to -- we'll say yes.

Q. Perhaps you could accept it subject to check. I am trying to be vague so that you don't have to be nailed down.

A. Yes.

Q. Now that sort of problem is much less acute with a station like Pickering, isn't it, because it's so close to a major load system?

A. What sort of problem?

Q. The problem of transmission losses.

A. No.

Q. The transmission losses from Pickering would be comparable for its generation to say the transmission losses from Bruce?

A. I would think the transmission losses from Bruce would be greater than they are from Pickering.

Q. Exactly. So, in terms of your lost energy, you lose less of the Pickering energy than the Bruce energy, don't you?

A. Sorry, yes. I took you to mean the opposite.

Q. Oh.

Now, I guess I am right in concluding then that if you could just locate all of your generating facilities really close to load, then while I take your point this morning that you couldn't eliminate transmission losses, you could certainly cut them down dramatically, couldn't you?

A. The closer it is to the load, the less will be the losses.

Q. And it is a geometric function; right?

MR. SNELSON: A. What do you mean by "geometric function"?

Q. Well, it is not a straight linear correlation between distance and losses, is it?

A. It may not be a linear correlation, but I am not sure that geometric, which --

Q. Well, maybe I should have said exponential.

MR. BARRIE: A. That doesn't help. (Laughter)

Q. It doesn't matter. Never mind.

Now your latest central generating station is Darlington.

THE CHAIRMAN: I think they have said - or I may be wrong - that distance isn't the only factor in transmission losses.

MR. SHEPHERD: Yes, that's correct.

Q. Your latest central generating station is Darlington?

MR. BARRIE: A. Yes.

Q. And that's not that far away from load, is it--

A. Right.

Q. --relative to some of your other generation?

A. It is closer to the main load centre than Bruce for instance.

Q. Is it fair to say that given the problems that you have had getting that approved and up and running, that you may face pretty significant problems getting other central generation approved close to load?

A. I am not in a position to answer that.

Q. Well, Mr. Snelson, you are the planner. Is that a factor you take into account in determining where you put things?

MR. SNELSON: A. We obviously look for generation sites that are well situated. As I said this morning, proximity to load is one factor. Other factors are whether or not they can be managed in an environmentally and socially acceptable way.

And there are also technical considerations such as availability of cooling water, good site foundation conditions, and a number of other factors. So, those are factors in choosing sites for new generating plant.

Q. You have now about 1500 megawatts of non-utility generation on the system. Is that about right, give or take a hundred?

A. It's more than 1200, and 1500 sounds a little high to me, but subject to checking it...

Q. Okay. Where is that in relation to load? Is it generally closer to load than central generating stations or farther away from load than central generating stations?

A. It is probably, most of it, further away from our main load centres, in that a large part of it is associated with pulp and paper plants and other large industrial establishments. And we established this morning that 50 per cent of our load was within the sight of the top of the CN Tower, and I think that quite a small proportion of that non-utility generation is within sight of the top of the CN Tower.

Q. Isn't it also true, though, that the vast majority of the non-utility generation that you have on the system directly feeds a load that is adjacent to it?

A. That is correct, yes.

Q. And isn't it also true that even when they aren't close to load, the NUG's don't tend to be concentrated in groups in the same way as for example the amount of generation you have concentrated around Bruce? They tend to be more diverse, more decentralized?

A. They tend to be more diverse and that might have either an effective increasing or decrease in transmission costs.

Q. I wasn't thinking so much of transmission losses at that point as questions such as locked-in energy don't arise with respect to NUGS no matter how many you have, do they?

A. If you were to build a non-utility generator and fail to get approval from the transmission line to connect it to the system, then it would be subject to locked-in energy just the same as the Bruce nuclear generating plant.

Q. Fair comment.

Aside from that situation, you don't find locked-in energy to be a problem with NUGs, do you?

MR. BARRIE: A. Not at the moment. But I think it is true to say in the northeastern region, we did not go ahead with the transmission reinforcements being planned for the northeast; that all the NUGs now being planned for that area, you would have occasions of locked-in energy.

...

[4:35 p.m.] So, although it hasn't been a factor at this point, conceivably it could be one if we didn't do transmission reinforcements.

Q. Okay. I am looking now at Interrogatory 2.14.26, and am I right in understanding paragraph A of that to mean that, in general, NUGs reduce transmission and distribution losses, or am I taking too big a leap there?

MR. SNELSON: A. Paragraph A means what I believe it says, which is that if a NUG is located in a load centre and it contributes power that is required in that load centre, then it would generally tend to reduce transmission or distribution losses.

Q. So, that would be like a cogenerator, for example.

A. A cogenerator may do that, and we give credit for that in our avoided cost calculation.

The sum total effect may be a little bit more difficult to determine, but generally speaking, we presume that to be the case.

Q. Let me turn to acid gas limits, just for a minute. I am going to come back to this later, but I just want to do a couple of technical questions on it now.

You said that acid gas limits will limit

economic dispatch, right? You may not be able to proceed with economic dispatch because of acid gas limits preventing you from using the cheapest units?

MR. BARRIE: A. What I said was that in 1990, we changed our order of dispatch to take account of acid gas concerns.

Q. And is the result of that, in dispatching your coal units, you don't do the cheapest ones first, you do the cleanest ones first?

A. In 1990, that happened.

Q. Is that no longer true?

A. That is no longer true.

MR. TABOREK: A. The one instance in which environmental factors would change dispatch, the one prominent instance, is if we had a unit with a scrubber and a unit without a scrubber, we would normally try to use the unit with the scrubber as much as possible, give it a priority in dispatch.

Q. But you don't have any units with scrubbers.

A. Not yet, but we will have in '94.

MR. BARRIE: A. So, in 1991, there is not -- the acid gas concerns are not changing the way we are dispatching the fossil generation.

MR. TABOREK: A. Environmental dispatch

and economic dispatch for us simply are the same because we are, in effect, burning a fixed batch of coal, and the economics and the environment are best served if that coal is burned in the most efficient unit. And so the two methods of dispatch are the same, by and large, for our system. It is not as if we can introduce new batches of coal from somewhere.

Q. Okay. And do I understand correctly that sometimes you just plain can't use the coal units because of acid gas problems and you have to buy the power instead from elsewhere?

MR. BARRIE: A. That occurred in 1990, yes. The acid gas restriction basically put a cap on the amount of fossil generation we could use.

MR. TABOREK: A. It's a low probability event.

Q. You don't expect it to ever happen again?

A. I don't think I would be that direct about it. It has happened once in the past 10 years.

MR. BARRIE: A. Our forecast for the next five years do not show any need for those kind of control actions. However, the kinds of uncertainties we have described on numerous occasions in this testimony could occur of course.

Q. Am I right in understanding that acid gas is a particular problem because you have a calendar year restriction, and when you get to December when you need the power the most, that's when you are also most likely to be at your limit, or close?

A. This was an added complication that we faced in developing our monthly strategy to meet an annual restriction, in that we were approaching the time where, as you say, our fossil production is coming to its peak, just as we are reaching the end of the year.

So, unfortunately, if you are getting close to the limit at that point, you are in a lot of trouble. You should have taken your correctitive measures before that.

Q. Do you ever do economy energy swaps with other jurisdictions, other utilities where you buy some of their power late in December and sell them back some in January to cover off your acid gas limits?

A. I don't know of such a transaction.

Q. You don't think you do that?

A. I don't know of such a transaction.

Q. If it happened, would you normally know about it?

A. Yes.

Q. I would like to turn to the question of dispatchability, which you haven't talked about conceptually at all, and in that context to look at your hourly load duration curves. It seems to me, looking at the load duration curves -- not the load duration curves, sorry, the chronological load curves that you have provided in your direct testimony, that they have the same sort of pattern on a daily basis, except that the numbers are different each day, but the pattern is roughly the same. It's fairly predictable.

A. There are some changes between summer and winter, but the pattern is similar. The demand is always lower at night than it is during the day. The demand is fairly flat throughout the day. But there tends to be a morning peak and an evening peak, but yes.

Q. I would like you to turn up Interrogatory 3.14.67. This was a question about what dispatchability means. Have you had a chance to look at this? Are you familiar with this material?

A. I provided my comments to Panel 3 who prepared this for you, yes.

Q. You have seen it before.

A. I have seen it, yes.

Q. My reading of this is that

dispatchability isn't an all-or-nothing concept, that there are various levels of dispatchability depending on the nature of the option and what your system needs are; is that right?

A. I think that's fair, yes, and that's the gist of this interrogatory.

Q. And so you have nuclear and fossil units which are dispatchable -- well, fossil units are dispatchable in hours, essentially, and nuclear units, although perhaps dispatchable, are rarely dispatched. They are sort of left to just keep on chugging; is that about right?

A. I think fossil plant is dispatchable by minutes rather than by hours. Did you say hours?

Q. I said hours, yes.

A. We can vary the output from a fossil unit and we can change it in terms of minutes. But what you said about nuclear was correct, yes.

Q. And hydraulic units and CTUs are the fastest, right? You can move them around really fast?

A. Hydraulic we can move around very fast. The reference to CTUs is that we can bring it from zero on very quickly, as distinct from a machine that's already on and its ability to pick up load quickly.

Q. So, if you compared that to a coal unit, for example, a CTU can go from zero to -- its acceleration is really fast--

A. That's right.

Q. --whereas the fossil unit is much slower?

A. So, the CTU we can leave off and not be incurring any costs while it's off, and we can ask for it to come on and it will come from zero to some megawatts reasonably quickly.

Q. On a practical day-to-day basis, I understood your direct testimony to be that you need dispatchability because you never know from minute to minute just how much load you will have, but the vast majority of your generation is scheduled on a daily or a weekly or a monthly basis; right?

A. You need dispatchability for two reasons. You need it to meet the variations we know about. We know we are going to have to dispatch generation to meet the morning load pick-up, the evening drop-off, and the variations throughout the day. That's sort of the known dispatchability, if you will.

The other requirement is that it can respond when something happens that we don't know

about, if we lose a generating unit, if there is a sudden increase in demand, or something like that. So, there are the two and I think they're both a requirement.

Q. And when you described the problems you had over that weekend in your direct testimony, that was, I guess, a good combination of the two types of dispatchability, right?

A. Yes.

Q. You plan some things for the next day or day after and some things you just did right away?

A. That's correct.

Q. And is it true that, to the extent that your load patterns have predictability, you will tend to use more of your planned generation, you will plan in advance, and to the extent that it is less predictable, your load patterns are less predictable, you will tend to need more minute-to-minute dispatchability?

A. I don't understand that question.

Q. The more you know in advance what you are going to need at any given point in time, the more you can schedule generation to meet it in advance, and conversely, the more unpredictable your load, or your need, the more you need short-term dispatchability to

solve the load requirements; is that correct?

A. I think that's correct, yes.

Q. It's pretty basic.

MR. SNELSON: A. There are different levels of predictability. There are the load curves that we kind of show that show low loads at night and high loads during the day, and the proportions as to where the peak occurs in the day and whether it's two peaks or one peak, and whether it's a peak in the morning, a peak in the evening or a peak in the middle of the day, that varies through the year. And the patterns are actually in Interrogatory 2.7.67.

But, coming to this question of predictability, the generation schedule plan that Mr. Barrie talked about, which is prepared a day ahead, is not the things that can't be predicted; it's the things that can be predicted with a lead time of one day.

So, for instance, it will account for the fact that the current weather forecast for tomorrow is that tomorrow is going to be very hot and that there will be a lot of air conditioning and that we need to have a lot of generation on line. Now, that can be predicted today, but it couldn't have been predicted a month ago and it couldn't have been predicted a year ago.

So, there are things that can be predicted with different sorts of lead times. And so you can't just make a clear distinction between that which is predictable on a long-term basis and that which is predictable on a minute-by-minute basis. There are sizeable uncertainties which may be predictable on a day-ahead basis or two days ahead, but not on a year-ahead.

Q. Let me shift for a minute and ask about the concept of load following. Suppose, just hypothetically, you have demand management or a non-utility generation option that naturally follows a pattern similar to load. Take, as an example, efficient lighting, efficient office lighting, that would tend to follow a pattern similar to load, wouldn't it?

A. If it was in a commercial building where the lights were turned on at six o'clock in the morning and off at seven o'clock at night, Monday to Friday and not on at weekends, then it would have quite a high coincidence with peak loads.

Q. So, it's a good example, then, commercial efficient lighting?

A. Yes, it's a fairly good example.

Q. Let's use it then.

And isn't it true that any option that supplies, or in the case of a demand management option, reduces demand, more closely following your chronological load curve than simply random is beneficial to you, it helps you?

A. Yes. And that is recognized in our avoided cost calculations.

...

[4:50 p.m.] Q. Oh, yes, I know. And that is true whether it is demand management or whether it is non-utility generation; if they follow load, they tend to be valuable?

MR. BARRIE: A. Yes.

Q. Now, I am just going to - because I don't want to waste my overheads - I am just going to take you through an example and tell me whether you think this example makes sense.

If you will look at overhead No. 8, page 8 of Exhibit 158. And please suspend your judgment on the numbers. I am just trying to demonstrate and the numbers are probably vastly oversimplified.

What we have done here is we have taken your average daily load shape for December '89, which happens to be the latest of the sets of numbers you provided to us. And then we have just assumed, for argument's sake, that you ran 16,000 megawatts of base load throughout the month, which undoubtedly you didn't, but let's just assume that for simplicity.

Then the next overhead just calculates -- and this is No. 9, says, "This is what you needed to deal with, in excess of base load."

Now, Mr. Barrie I know I am oversimplifying and if it gets so off the wall that it

doesn't make any sense, please stop me. But so far, I am sort of giving the sense, am I right?

And then, the next one, No. 10, postulates a combination of demand management and non-utility generation options that partially follow load. They don't follow it exactly, but they tend to be higher when load is higher and they tend to be lower when load is lower. Does that look about right to you?

A. It seems to follow it exactly.

Q. I mean, obviously -- well, except that the peaks aren't as high and the valleys aren't as low. They are done on purpose.

A. It is never going up when demand is going down.

Q. Okay. Fair enough. I am oversimplifying to make a point.

And then No. 11. In overhead 11 what we have done is we have said, okay, let's take that top band, which is what you have to deal with on a day-to-day basis, and see what it looks like in absolute terms; how much supply do you have to find during that time? And that is obviously a lot lower than it was, right?

A. Yes.

Q. And finally, No. 12 - and this is, of

course, the whole point - compares the two. And you will note at the top that it indicates that the average demand management and NUG that you are "buying" is 1279 megawatts.

But it looks to me like the peak you are shaving by having load following in this example only, which is a hypothetical, is over 2,000 megawatts.

Is that sort of effect -- is that what load following does in general, forgetting the quantum for a second and just looking at the generic result?

MR. SNELSON: A. As far as NUGs and demand management are concerned, then if it is a less than 100 per cent load factor load - so the average load is less than the peak load - and if the peak load tends to coincide with our peak load, then it will have a bigger reduction on peak load than it would do on average load.

Q. Okay. And then that is the sort of value you get then? I mean, that is the sort of thing that happens. Your operational problems day to day are less because you have less peak to deal with, right?

A. This is looking at just within-a-day variability. There are also day-to-day variabilities as well.

Q. Yes, of course.

A. As we described.

Q. Well, if we go back to the original example of efficient lighting, that would tend to be an option that most demand management options that follow load will tend to follow load fairly closely, right?

A. Not necessarily.

Q. Okay. Why?

A. Well, let's say that the - and your commercial lighting example is perhaps a good one - hence, that this is a fixed load on weekdays during working hours, which tend to be peak hours.

Q. Yes.

A. The variability from day-to-day may be driven by other things, such as--

Q. Like weather?

A. --weather. And the lighting load may not be closely related to weather. The lights are going to be on in the office when it is a hot day or a cold day.

Q. So, in fact, something like space heating would be correlated to weather?

A. Space heating would be correlated to weather-driven effects caused by cold weather.

Q. So, just hypothesize for a moment a package of demand side options that include space

heating and efficient lighting and all those sorts of things. Am I right in assuming that, in general, those should tend to follow load pretty closely, including the day-to-day variations?

A. It would depend on what was in the package.

Q. Okay. I am almost finished this point, Mr. Chairman, so maybe I will just finish it and then it will be over.

Now, you are anticipating increasing amounts of the demand side management and NUGs on the system over the planning period, aren't you, both as a percentage and in absolutes?

A. We are planning for them, yes.

Q. And are you anticipating that they will, in general, follow load or to some extent follow load?

A. Some we expect to follow load closely and some we do not expect to follow load closely.

Q. Let's take all of demand side management, for example.

Overall, does your plan anticipate that your demand side management plan is going to produce in aggregate a load following option?

A. I think it is probably true to say

that we expect the demand management to have a tendency towards higher reductions during times of high loads than the low loads to have some element of load following.

Q. And do you also anticipate that because of time differentiated buy-back rates for non-utility generators, that NUGs will tend to follow load?

A. That is one that I am very cautious about giving a 'yes' to. Mr. Vyrostko on Panel 5 will be able to tell us more specifically how non-utility generators are reacting to time-differentiated rates.

If the night-time energy rate is high enough that it is still incrementally profitable for them to continue to generate overnight, then they will still continue to generate overnight.

In some cases, if they have limited water capabilities in a hydraulic plant and have storage,, then we would expect time-of-use rates to encourage them to use that water during the daytime when it is at the highest value.

Q. Am I right that it is to a large extent - not entirely but to a large extent - a function of just how low your off-peak rates are?

A. It depends on how low the off-peak

rates are and it also depends upon the type of plant that the non-utility generator has.

For instance, if it is a cogeneration plant, then the operating patent tends to be driven by the patent of steam requirements.

So, if it is connected to a plant that is working 24 hours a day and needs steam 24 hours a day, then the non-utility generator might very well choose to generate electricity 24 hours a day.

MR. SHEPHERD: Okay. Perhaps I could leave it there, Mr. Chairman.

THE CHAIRMAN: Thank you. We will adjourn until ten o'clock tomorrow morning.

---Whereupon the hearing was adjourned at 5:00 p.m., to be reconvened on Thursday, the 30th day of May, 1991, at 10:00 a.m.

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